Defence Research and Development Canada
Recherche et développement pour la défense Canada

Simulation technologies for C^{2}IS development & training

Final report

Thibault, D. U.
DRDC Valcartier

Defence R&D Canada – Valcartier
Technical Report
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Abstract

A functional overview of the High Level Architecture (HLA) distributed simulation standard Institute of Electrical and Electronics Engineers (IEEE) 1516 is provided. The Agent Oriented Software (AOS) intelligent software agent development environment, JACK, is described. Problems with the IEEE 1516 specification are identified and possible improvements outlined. A demonstration Internet Relay Chat (IRC)-like application is designed and implemented, which allows a Java application to interoperate with a JACK application through the HLA. A re-usable JACK capability is described which allows any JACK agent to participate in an HLA federation. A re-usable framework of Java classes implementing the HLA Object Model Template (OMT) encoding and decoding facilities is described. Finally, bugs are documented in JACK and the HLA Run-Time Infrastructure (RTI) used, and various design considerations and lessons learned are discussed.

Résumé

Le fonctionnement de la norme de simulation répartie High Level Architecture (HLA) Institute of Electrical and Electronics Engineers (IEEE) 1516 est décrit de façon concise. L'environnement de développement d'agents logiciels intelligents JACK d'Agent Oriented Software (AOS) est décrit. Des problèmes sont identifiés au niveau de la norme IEEE 1516 et des améliorations possibles sont décrites. Une application semblable au clavardage Internet a été conçue et implémentée, permettant de démontrer comment HLA permet l'interfonctionnement d'une application Java avec une application JACK. Une capacité JACK réutilisable permettant à n'importe quel agent JACK de participer à une fédération HLA quelconque est décrite. Un cadre de classes Java implémentant les méthodes de codage et d'encodage de l'Object Model Template (OMT) HLA est décrit. Finalement, les bogues de JACK et du Run-Time Infrastructure (RTI) HLA sont documentés, et diverses considérations et leçons apprises discutées.

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Executive summary

Distributed simulation, both in its logical and geographical senses, allows one to leverage existing and future simulations to the best of their individual capabilities. Live, virtual, and constructive simulations are all susceptible to benefit from a distributed implementation. A *live simulation* involves real people operating real systems; the latter are modified (blanks instead of live ammunition, for example) or augmented (laser tag equipment, for example) in order to allow realistic action to occur without the actual risk of casualty or destruction. A *virtual simulation* involves real people operating simulated systems; the humans are in-the-loop in a central role, exercising motor control skills, decision, or communication skills. A *constructive simulation*, finally, involves simulated people operating simulated systems. Under certain conditions, constructive simulations are the only ones that can be run at vastly increased simulated rates of time lapse. For example, an entire large-scale operation spread over days or weeks could be simulated in a matter of seconds, given powerful enough (and smart enough) computers.

Geographical distributedness allows the simulation audience to be widely spread across actual space, as long as this does not compromise the illusion. Obviously, a real person and a real piece of equipment must be co-located for the one to operate the other, but if other entities are perceived artificially (e.g. through the tactical radio, through a radar screen, or through a simulated outside view), distributedness in principle allows them to be at arbitrarily large distances from each other (in practice, time lag problems limit the actual distances achievable). The immediate benefit is to allow exercises of any scale to occur at lesser cost in time and expense, as the participants need not move to a central location. Similarly, there is a lesser need in infrastructure. For example, instead of several sets of simulator units being installed in several locations, each one able to accommodate a full platoon, there could be only one platoon's worth of simulators, each individual one at a separate location.

Logical distributedness occurs independently of geographical distributedness; its essence lies in breaking down responsibility for various aspects of the simulation across different simulation software entities. This allows greater fidelity to be achieved by the combined simulation than would be possible using each participating simulation by itself. Each participating simulation, by mutual agreement, becomes responsible for one or more aspects of virtuality for which it is the recognised "expert." For example, an all-purpose simulation that includes a crude missile fly-out model could, through logical distribution, turn over responsibility for its missiles' flight to a specialised simulation, thus improving the realism of the whole. Another example would be target detection; once the host simulation has established line of sight exists between any two platforms, it could rely on another simulation to resolve whether detection occurs or not, the latter simulation using a sophisticated atmospheric propagation model to do so.

The benefits of logical distributedness are many, not least of which is a large potential for systematic re-use of models and simulations of established validity and sophistication. Putting together a simulation for some specific need, be it training or research, then becomes a matter of determining which aspects require the most fidelity, and looking up the appropriate contributing simulations in some catalogue. Users are no longer locked into some specific investment (monolithic simulation environment), but may switch freely to improved components as they arise. Developers are free to specialise in some narrow aspect of their model, knowing any "deficiencies" their model may have in other aspects will easily be compensated, if needed, by the integration of the appropriate components.

Distributed simulation is made possible through the High Level Architecture (HLA) standard, now in its second generation: Institute of Electrical and Electronics Engineers (IEEE) 1516. This document summarises the intricacies and subtleties of the standard in what is hoped to be a complement to the standard's defining documents themselves. Time management is given minimal treatment while ownership and data distribution management are looked at in detail. The specification, as amended by the U.S. Department of Defense (DoD), is discussed and apparent ambiguities and lacunae are identified, with solutions proposed.

Since the only fully certified Run-Time Infrastructure (RTI; the concrete implementation of the middleware standard) at this time is Pitch's pRTI1516, that is what was used. Few problems were encountered, and these are documented. No comparisons or performance benchmarking could be conducted.

A leading software intelligent agent design environment, Agent Oriented Software's JACK, is summarised so that a clear picture of the component blocks of an agent application emerges. The task of integrating a given JACK agent into an HLA federation is tackled, using as an example a multi-user communication application modelled after Internet Relay Chat (IRC).

Difficulties inherent in multi-threading applications were encountered, and the mechanisms required to surmount them within the HLA paradigm were implemented. Retrospection reveals how several of these could be improved, and this is discussed.

A re-usable JACK "capability" module was designed and implemented, and quickly retrofitted to the older 1.3 standard. A re-usable and extendable framework of Java classes implementing the HLA Object Model Template (OMT) encoding and decoding facilities is described and implemented. It can be used until such time as an evolved version of HLA IEEE 1516 appears which resolves the related issues. Miscellaneous other utility classes are provided as well.

It is hoped that the work will facilitate the integration of intelligent agents such as those made possible by JACK into existing or future simulations in use by the Canadian Forces, or by various Defence Research & Development Canada projects, such as those looking into cognitive effects and other human factors. The work should also be of some use to any effort involving HLA in general.

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Sommaire

La simulation répartie, dans ses sens logique et géographique, permet d'exploiter au mieux de leurs capacités individuelles les simulations contemporaines et à venir. Les simulations réelles, virtuelles et constructives sont toutes susceptibles de bénéficier d'une implémentation répartie. Une *simulation réelle* implique des personnes réelles faisant fonctionner des systèmes réels; ces derniers sont modifiés (p. ex. fausses balles) ou augmentés (p. ex. équipement laser) afin de permettre le réalisme sans encourir les risques habituels de destruction ou blessure. Une *simulation virtuelle* implique des personnes réelles faisant fonctionner des systèmes simulés; les humains sont dans la boucle de façon centrale, exerçant leur habileté manuelle, ou leurs compétences de décision ou de communication. Une *simulation constructive*, enfin, implique des personnes simulées faisant fonctionner des systèmes simulés. Dans certaines conditions, les simulations constructives sont les seules à pouvoir être exécutées à un rythme fortement accéléré. Par exemple, une opération à grande échelle se déroulant pendant des jours ou des semaines pourrait être simulée en quelques secondes, si la puissance (et l'intelligence) des ordinateurs le permet.

La répartition géographique permet au personnel impliqué d'être éparpillé spatialement, du moment que l'illusion n'est pas compromise en ce faisant. Évidemment, une personne et un équipement réels doivent être au même endroit afin que l'un puisse faire fonctionner l'autre, mais si les autres entités ne sont perçues qu'indirectement (p. ex. à travers la radio tactique, un écran radar ou encore une vue extérieure simulée), la répartition permet, en principe, à ces entités d'être à une distance réelle arbitraire (en pratique, les délais de transmission limitent les distances réelles permissibles). Le bénéfice immédiat est que les exercices, quelle que soit leur échelle, peuvent être réalisés à moindre coût en temps et ressources, car les participants n'ont plus à se rendre physiquement à un même endroit. Similairement, il y a un besoin moindre en infrastructure. Par exemple, au lieu de plusieurs ensembles de simulateurs installés en divers endroits, chacun en mesure d'accommoder un peloton entier, il devient envisageable d'avoir un seul peloton de simulateurs, répartis en divers endroits à la pièce.

La répartition logique peut avoir lieu indépendamment de la répartition géographique : son essence consiste à distribuer la responsabilité de divers aspects de la simulation entre différentes entités logicielles. Ceci permet à la simulation combinée d'atteindre une fidélité supérieure à celle possible avec une seule des simulations participantes. Chaque participant, d'un commun accord, se charge des aspects de la virtualité pour lesquels il est reconnu être l'« expert ». Par exemple, une simulation à tout faire qui inclut un grossier modèle de vol de missiles pourrait, grâce à la répartition logique, confier la responsabilité du vol de ses missiles à une simulation spécialisée, améliorant ainsi le réalisme de l'ensemble. Un autre exemple pourrait être l'acquisition de cibles; une fois que la simulation hôte a établi l'existence d'une ligne de visée entre les plateformes impliquées, elle pourrait se fier à une autre simulation (utilisant un modèle de propagation atmosphérique sophistiqué) pour déterminer s'il y a détection ou non.

Les bénéfices de la répartition logique sont nombreux, à commencer par la réutilisation systématique de simulations dont la validité et la sophistication sont établies de longue date. La conception d'une simulation répondant à un besoin spécifique, qu'il s'agisse d'entraînement ou de recherche, consiste alors à déterminer les aspects requérant la plus grande fidélité, pour ensuite identifier les simulations devant être mises à contribution dans un catalogue. Les utilisateurs ne sont plus prisonniers d'un investissement quelconque (un environnement de simulation monolithique), mais peuvent transitionner librement vers des composants améliorés lorsqu'ils surviennent. Les développeurs sont libres de spécialiser leur modèle, sachant que les "déficiences" que leur simulation pourrait présenter seront facilement compensées, si nécessaire, par la participation d'autres simulations.

La simulation répartie est rendue possible par la norme High Level Architecture (HLA), qui en est maintenant à sa seconde génération: Institute of Electrical and Electronics Engineers (IEEE) 1516. Ce document en explique les subtilités et les détails d'une façon qui se veut complémentaire aux documents de la norme eux-mêmes. La gestion du temps se voit accorder un minimum d'attention, tandis que la gestion de la propriété ainsi que la gestion de la répartition des données sont examinées attentivement. La norme, telle qu'amendée par l'U.S. Department of Defense (DoD), est discutée et d'apparentes ambiguïtés et lacunes sont identifiées, et des solutions sont proposées.

Puisque le seul Run-Time Infrastructure (RTI; la réalisation concrète de la norme intergicielle HLA) pleinement certifié lors de ces travaux est le pRTI1516 de Pitch, c'est ce qui fut utilisé. Quelques problèmes furent rencontrés, et ils sont documentés. Il n'y avait pas lieu de faire des comparaisons ou des étalonnages de performance.

Un environnement de conception d'agents logiciels intelligents d'avant-garde, JACK d'Agent Oriented Software, est décrit avec suffisamment de détail pour qu'une idée claire puisse se faire des composants qui constituent une application faisant usage d'agents intelligents. Nous nous attelons ensuite à la tâche d'intégrer un agent JACK donné à une fédération HLA, en utilisant comme exemple une application de communication à multiples usagers, simulant de près le clavardage Internet.

Des difficultés inhérentes aux applications multi-fil ont été rencontrées, et les mécanismes permettant de les surmonter dans le contexte du paradigme HLA ont été implantés. Une rétrospective révèle comment certains de ceux-ci pourraient être améliorés, et ces options sont discutées.

Un module de "capacité" JACK réutilisable a été conçu et réalisé, et rapidement rétro-ajusté à l'ancienne norme HLA 1.3. Un cadre de classes Java réutilisable et extensible réalisant les méthodes d'encodage et de décodage de l'Object Model Template (OMT) HLA est décrit et réalisé. Il pourra être exploité jusqu'à ce qu'une version évoluée d'HLA IEEE 1516 apparaisse qui résolve cette difficulté de la norme courante. Diverses autres classes utilitaires ont été également réalisées.

Ces travaux devraient faciliter l'intégration d'agents intelligents comme ceux rendus possibles par JACK à des simulations existantes ou futures, utilisées par les Forces canadiennes ou par divers projets de Recherche et développement pour la défense Canada, comme ceux touchant aux effets cognitifs et autres facteurs humains. Ces travaux devraient également être de quelque utilité pour tout effort impliquant HLA en général.

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1. Introduction

General

Modelling and simulation (M&S) are recognised as tools of paramount importance throughout the military endeavour. Physical M&S can be used to evaluate engineering solutions to specific problems (e.g. Which shape of helmet best protects against a projectile impact? Which layering of materials offers the best armour protection against a specific threat? Which disposition of controls best suits the ergonomics of the cockpit?). Logistics and demographics simulations can be used to evaluate force deployability and sustainability solutions. Virtual and real simulations are constantly used in training at all levels, ranging from small arms individual training, through simulators (aircraft, armoured vehicles, ship bridges) all the way up to command post exercises. Simulations are also extensively used in the design phases of acquisition projects, to refine requirements, identify errors before they result in expenses, and identify potential synergies. During real operations, simulations can be used to put to the test proposed friendly (or suspected enemy) courses of action, identifying overlooked opportunities or threats. And so on.

Faced with this overwhelming breadth of applicability and abundance of diverse applications, simulation interoperability quickly emerged as a lynchpin. The High Level Architecture (HLA) is the still-evolving standard that strives to make this interoperability happen.

Background

In the Research and Development (R&D) domain, it is necessary to explore a variety of issues with a minimum of effort and expenditure of resources. Both to ensure the validity and applicability of the research and to avoid duplicate development and maintenance, the simulations used in R&D ought to be the same as (or at least have much in common with) those used in the military community. However, in the military application domain simulation is overwhelmingly used for training purposes. Command and control (C^2) training simulations perforce do *not* automate or simulate the C^2 process, since that is precisely the expected trainee benefit. One can oversimplify the situation like this: for training purposes, the more humans are involved, the better. New equipment is introduced in the training scenarios only shortly before it is actually deployed. The preparation and execution of the scenarios is a complex, labour-intensive affair. Hence the conundrum: simulations designed for training purposes have manpower requirements which make them poorly suited to the R&D environment.

Consequently, R&D tends to minimise the scope of simulation vignettes used to explore new concepts, in order to make the running of the simulations achievable with a minimum of personnel. This approach is quite successful in the "material" domains, but what if one wishes to study the complex interactions of multiple systems in the overall C^2 process? The number (and nature) of entities to be simulated cannot be reduced without voiding the purpose pursued. There is a need to provide a reasonable level of "intelligence" to the entities. This is, of course, a much harder problem than physical simulation, but artificial intelligence has made some progress over the decades since its inception.

One of the paradigms that holds a fair amount of promise nowadays is the so-called intelligent agent approach, which strives to provide software entities with deliberative and pro-active qualities.

Context

The 12sd *Simulation technologies for C^2 information system (C^{2}IS) development & training* project was known as 12kr before 2003. Briefly designated 2kq when created in 2000, it was at first called *Army C^{2}IS development and training through simulation.* The project was an administrative means of regrouping a number of disjointed work units. The original aim was "To demonstrate an HLA simulation federation involving a simulation engine (with emphasis on OOTW support), command agents, an LFCS stand-in, an intelligence CCIS subset (ASIP) and decision aid tools." The objectives were:

- *Command Agents:* Explore models of the decision making process of military command and formalise a command model (below battalion, e.g. section, platoon, company and battalion) derived from contemporary artificial intelligence. The models must be flexible enough to represent doctrinally different allies and enemies as well as non-military entities (insurgents, refugees, organized crime, non-governmental organizations, etc.).

- *Tools:* Explore development and implementation environments and tools applicable to HLA object models (simulation and federation), HLA federation development process management, and command agents.

- *Analysis:* Evaluate the efficiency of command agents in land tactical CCIS over a distributed simulation environment. Evaluate several different mixed CORBA/HLA distributed environments. Evaluate desirable levels of HLA compliance on the part of the CCIS.

- *Demonstration:* Demonstrate the usefulness of the federation by using it to test advanced land intelligence tools in a fully interactive peace-keeping simulated exercise.

- *Interfaces:* Explore 3D visualisation and multi-modal interfaces for exercise/experiment preparation and execution.

With the eventual termination of one of the work units, the splitting off of another, and unexpected difficulties due in part to the immaturity of the domain and shifting standards, considerably less was achieved than hoped at the outset.

This report concerns the 12sd11 work unit, *Simulation technologies*. Besides the work being reported here, there was also another report, *Conformation à et exploitation de HLA par ASIP* (*ASIP Compliance to and Exploitation of HLA*), written by Catherine Daigle ([1] Daigle 2001), who later became a member of DRDC Valcartier's Decision Support Systems (DSS) Section. This report is included alongside this one on the CD (Compact Disc).

The 12kr12 work unit, *Command agents in simulation*, was the responsibility of : Kenneth N. Ackles and Dr. Benoît Jean Fugère of the Royal Military College (RMC) Kingston. The goal was originally stated as the "exploration of models of computer-generated forces (CGF) under command, which must react to orders and the enemy in a realistic, doctrinally sound manner." This was tightly integrated with the RMC graduate programs in Military Modelling & Simulation and RMC's implication in the High Performance Computing Virtual Laboratory (HPCVL). A prototype armoured squadron set of command agents (using JACK) was allegedly completed. Alternate architectures involving neural networks and fuzzy logic were investigated. No reports were ever delivered to Defence R&D Canada (DRDC), although a number of theses were written and papers were published ([2] Liang and Fugère 2000, [3] Liang et al. 2001, [4] Robichaud 2001, [5] Liang and Fugère 2002, [6] Jaillet et al. 2002). The decision was made to terminate the work unit in early 2003.

The 12kr13 work unit, *New media*, was the responsibility of Roger Fortin of DRDC Valcartier. It concerned itself with a novel interface device, a Topographical Map Display (ToMaDi) ([7] Fortin 2001a). Second and third generations of the prototype device were realised and field tested in three major military exercises. ToMaDi MkII ([8] Fortin 2001b, [9] Fortin 2001c) consists of a tiltable 4 by 4 matrix of sixteen colour Thin Film Transistor - Liquid Crystal Displays (TFT-LCDs, essentially portable computer screens) combined with a touch screen. It presents so far the only practical alternative to topographical paper maps for C^2 applications. With ToMaDi, it is possible to physically step back and view the entire map at once, and step up for the detail picture, without zooming in and out nor restricting access to one person at a time. Presently, two technologies are being investigated to make the ToMaDi's mullions vanish: aspheric lenses and retroprojection (reports in preparation). ToMaDi contributes to the digitization of the battlefield.

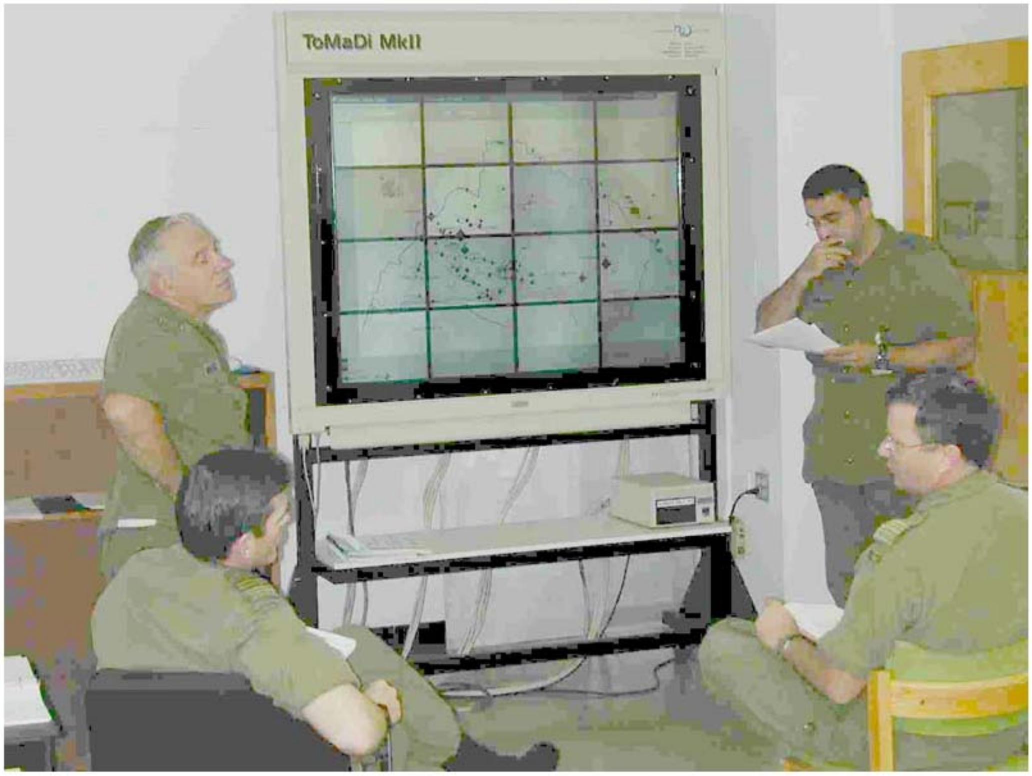

Figure 1. *The Topographic Map Display (ToMaDi)*

The 12kr14 work unit, *Urban simulation*, was the responsibility of François Létourneau of DRDC Valcartier. It split off from 12kr in fiscal year 2001-2002 to become 12kx, which later became project 15al *Geospatial technologies for information decisions (GEO-TIDE)*. The work focused on the development of three-dimensional models of urban areas, specifically Québec City. This entailed the purchase of 3D modelling software and visualisation hardware (e.g. an ImmersaDesk). Various methodologies of 3D urban model creation were examined in order to gauge the effort required and identify the challenges, stakes and technical and methodological considerations involved. Two reports documented this work ([10] Létourneau et al. 2003, [11] Martel and Létourneau 2003).

The 3D models of Québec City were used for technology demonstration purposes during the Summit of the Americas in 2001 by the RCMP headquarters. The *Soldier information requirements (SIREQ)* Technology Demonstration (TD) project asked 12kr14 to produce several versions of the Québec City 3D model which were used in an experiment that studied how different geospatial representations affected the capacity of soldiers to orient themselves in an urban operations field (reports in preparation).

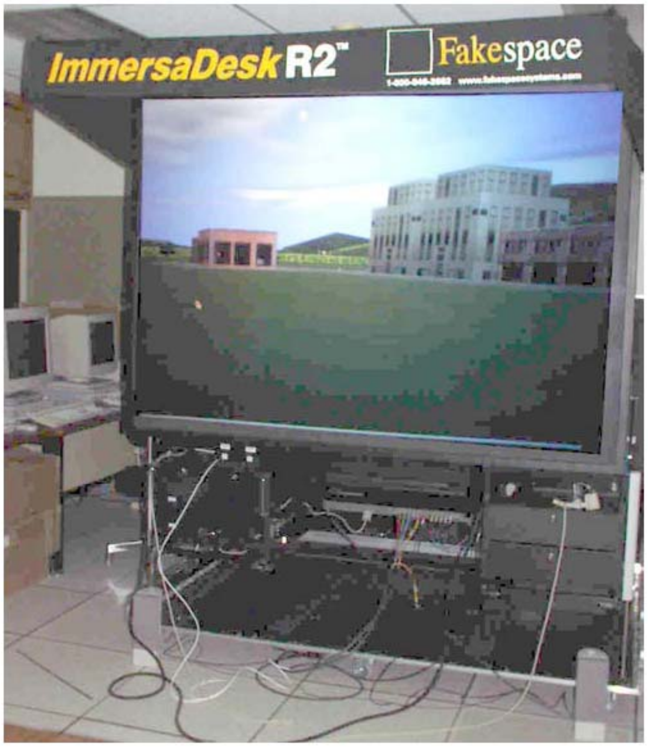

***Figure 2.** The ImmersaDesk*

The 12sd15 work unit, *Display assessment and enabling technology research for new military displays,* was also the responsibility of Roger Fortin of DRDC Valcartier, and a Defence Industrial Research (DIR) project. It was intended to provide enhanced display design capabilities through the application of commercially available display components via the development of enabling technology elements. The work focused on investigations into Active Matrix Liquid Crystal Display (AMLCD), Field Emission Display (FED), and Organic Light-Emitting Diode (OLED) displays and into the associated core technologies necessary to implement military displays. Solutions to a wide variety of display-related problems were identified and the basic technology foundations developed ([12] Thomas 2004). An OLED display was built and demonstrated.

Aim

The aim of this document is to provide a number of insights into the technical aspects of the current HLA standard, Institute of Electrical and Electronics Engineers (IEEE) 1516, and into the technical issues relating to its interface with one particular software intelligent agent development environment, Agent Oriented Software's JACK.

Intelligent agents model reasoning behaviour according to the theoretical Belief Desire Intention (BDI) model of artificial intelligence. They are autonomous software components that have explicit goals to achieve or events to handle ("desires"). To achieve their goals, the agents follow plans, which are high-level descriptions of expert behaviour. Set to work, the agents pursue their given goals (desires), adopting the appropriate plans (intentions) according to their current set of data (beliefs) about the state of the world. This combination of desires and beliefs initiating context-sensitive behaviour is a central characteristic of BDI agents.

Objectives

The specific objectives of this report are to:

- Provide an overview of HLA IEEE 1516, focusing on a subset of the services it provides;

- Provide an overview of Agent Oriented Software's JACK;

- Suggest improvements to the IEEE 1516 specification, building on those already promulgated by the U.S. Department of Defense;

- Document bugs in the only commercially available RTI that fully implements IEEE 1516, Pitch's pRTI 1516;

- Document bugs in the current version of JACK; and

- Document various design considerations, tips, tricks and lessons learned in implementing a specific federation.

Scope

This document is intended for those who are familiar with the high-level concepts of HLA and software engineering.

Outline

The sections examine, in turn, the HLA, the JACK intelligent agents, and the demonstration federation and Chat application. In the annexes, we comment on the IEEE 1516 specification, provide Javadoc for the HLA 1516 Application Programming Interface (API), document our re-usable supporting classes, provide a closer look at the Java Chat Client and provide its code, document the re-usable JACK capHLA1516 capability, and provide the JACK Chat Client code.

This document is also distributed in electronic form, as a CD-ROM (Compact Disc – Read-Only Memory). The CD's directory structure is as follows:

- `Java`
  - `bin`
  - `chat`
  - `doc`
  - `doccheck`
  - `lib`
  - `src`
- `JACK`
  - `chat`
  - `capHLA1516`
  - `capHLA13`

The Java source files are rooted at `Java\src`; for example, `hla.rti1516.AttributeHandle.java` is found at `Java\src\hla\rti1516\AttributeHandle.java`. The corresponding `class` files are rooted at `Java\lib`. `Java\bin` contains `jar` files that provide an alternate representation of the `class` files. The `doccheck` directory contains the results of running the `DocCheck` doclet on the source files, while the `doc` directory contains the generated Javadoc.

The code supplied in the annexes is found here:

- The `hla.rti1516` IEEE 1516 Java API with Javadoc added (Annex B);
- The `ca.gc.drdc_rddc.hla.rti1516 Integer64` family of `LogicalTime`[`Interval`][`Factory`] implementations called for by the specification but missing from the Pitch pRTI1516 product;
- The `ca.gc.drdc_rddc.hla.rti1516.omt` supporting classes (Annex C);
- The `ca.gc.drdc_rddc.hla.rti1516.FedAmb` supporting classes (Annex D); and
- The `chat` Java Chat client code (Annex E).

The JACK source files are in the `JACK` directory:

- The `chat` project (Annex F Part Two);
- The `capHLA1516` re-usable capability (Annex F Part One); and
- A `capHLA13` re-usable capability for HLA 1.3NGv6 (bonus).

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2. High-Level Architecture (HLA)

Historical Perspective

Computer simulation was developed hand-in-hand with the rapid growth of the computer. One of the very first large-scale efforts was the World War II Manhattan Project's computer modelling of the process of nuclear detonation. In the military domain, simulators had been used for individual training purposes long before the computer was invented. Likewise, the "war game" as a command training tool dates back at least to the Napoleonic era. Computers, naturally, were at first used to enhance these disparate tools on a piecemeal basis. Thousands of different computer applications were eventually developed to fulfill an immense variety of training and research requirements. Simulations grew from the bottom up, features being added every time they were felt necessary, leading to repeated reinvention of the same wheels. Interoperability was virtually non-existent. By the early 1980s, it was generally considered impossible to build an affordable, large-scale, collective, free-play, force-on-force, interactive, worldwide networked war fighting system ([13] Cosby 1999).

That is precisely what the U. S. Defense Advanced Research Projects Agency (DARPA) SIMulator NETwork (SIMNET) programme set out to disprove (SIMNET later became SIMulation NETwork, to reflect its widening span). Initiated in 1983, it was the first step in moving from individual task-based simulators to a network of low-cost simulators that fought on a virtual battlefield to provide "synchronized execution of collective war fighting skills in a combined arms and joint arena." Eventually, the University of Central Florida's Institute for Simulation and Training (IST) was contracted by DARPA to undertake research in support of SIMNET. The first draft of the resulting **Distributed Interactive Simulation (DIS)** protocol appeared in 1992 ([14] DIS 1992), and it quickly became an IEEE standard, IEEE 1278 ([15] IEEE 1993). DIS enjoyed considerable success and is still used in some contexts.

In 1989, DARPA started extending the SIMNET DIS principles to aggregate level constructive training simulations. The effort led in 1991 to the **Aggregate Level Simulation Protocol (ALSP)** which was first used to support major exercises in 1992 ([16] MITRE 1993). ALSP laid the theoretical foundations for the **High Level Architecture (HLA)** while becoming a multi-service program focusing on the support and execution of the Joint Training Confederation (JTC). By 1998, the ALSP Confederation would start transitioning to HLA.

Starting in 1995, the U. S. Defense Modeling and Simulation Office (DMSO) developed the High Level Architecture as a standard for distributed simulation that could support any kind of simulation (live, virtual or constructive, real-time or not) while encouraging re-usability as much as possible by not imposing semantics on the participating simulations ([17] Kuhl et al.). First published and adopted as the U.S. Department of Defense de facto standard architecture for distributed simulation on 10 September 1996 ([18] DoD 1996), HLA underwent several revisions, eventually becoming the Object Management Group (OMG) standard *Facility for Distributed Simulation Systems 1.0* in November 1998 ([19] OMG 1998a). The DMSO demonstration Run-Time Infrastructure (RTI, the implementation of the middleware allowing HLA distributed simulations to take place) underwent successive revisions in parallel, eventually stopping with version 1.3NGv6. It was provided free-of-charge to encourage experimentation and development. In 2002, distribution was shut down to avoid competing with the burgeoning commercial implementations of HLA.

Simultaneously with the OMG ratification process, the standard was submitted to the IEEE, partly in order to rely on a non-governmental standard, since American law requires the U.S. Department of Defense (DoD) to use such non-governmental standards when consistent with mission, priorities and budget resources. The IEEE gave it a thorough going over, resulting in IEEE 1516 in 2000-2003 ([20] IEEE 2000). The IEEE standard deliberately avoided including a Common Object Request Broker Architecture (CORBA) ([21] OMG 1998b) Interface Definition Language (IDL) specification (unlike HLA 1.3), leaving this up to the OMG. The result was the OMG *Facility for Distributed Simulation Systems 2.0* in February 2002 ([22] OMG 2002).

Version 2 of IEEE 1516 has just begun preparation and is expected to be released within the next few years.

The most recent edition of DoD 4120.24-M, *Defense Standardization Program (DSP) Policies and Procedures*, is dated 9 March 2000 and does not yet formally adopt either HLA 1.3 or IEEE 1516 ([23] DoD 2000). The situation is similar on the North Atlantic Treaty Organization (NATO) side, where Standardisation Agreement (STANAG) 4574, *Standardized Modelling and Simulation Information for High Level Architecture (HLA)*, ([24] NATO 1999) has yet to replace STANAG 4482, *Standardized Information Technology Protocols for Distributed Interactive Simulation (DIS)* ([25] NATO 1995). Nevertheless, the trend is clear: HLA is the way of the future.

Framework and Rules

HLA strives to be an interface definition which is flexible enough to accommodate any combination, in number and kind, of simulations. Live, virtual and constructive simulations can, in principle, be made to interoperate using HLA. HLA is fully described by the IEEE 1516 documents (see the Bibliography for a full list), so we do not reproduce them here. Instead, a brief overview and summary is provided.

The functional components are of two kinds: the *federate applications* and the *run-time infrastructure (RTI)*. The federate applications are the individual simulation applications. The RTI plays a role similar to an Object Request Broker (ORB) under the CORBA; it is the (very likely distributed) set of software services which links the federates together (see Figure 3).

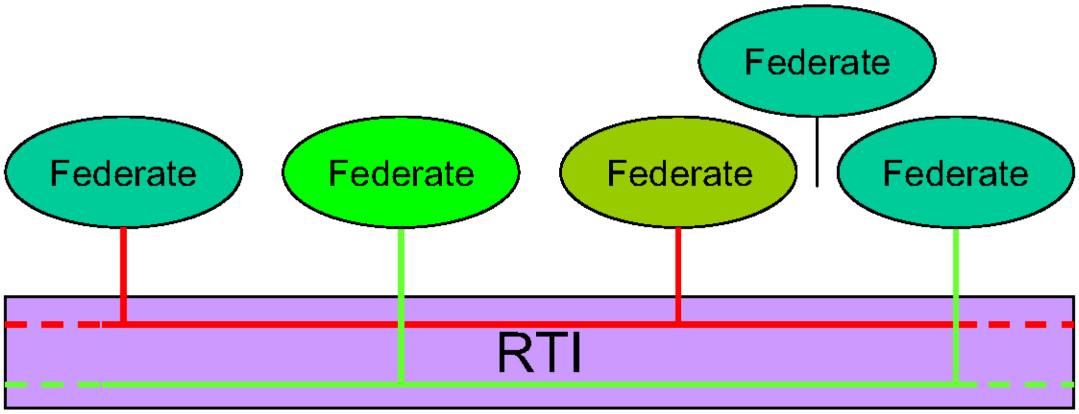

Figure 3. *High Level Architecture*
Here several federates participate in two different federation executions (red and green pipes) through the RTI. An unjoined federate can also be seen.

Each federate application has a Simulation Object Model (SOM): a software document written according to the rules laid out as part of the standard (the Object Model Template (OMT)). This SOM describes the objects, interactions, dimensions and other features of the simulation relevant to interoperability. Each version of the simulation application will likely have a different SOM, unless the changes are entirely transparent to the other federates. That is to say, implementation details can change freely, as long as the interface and the semantics do not. The actual operation, over time, of a federate application is referred to as a *federate*.

A *federation* is a named set of federate applications and a common Federation Object Model (FOM) that are used as a whole to achieve some specific objective. The FOM is best thought of as the relevant intersection of the SOMs of the federates involved (see Figure 4). The FOM is concretely represented by the FOM Document Data (FDD), although the two terms are essentially interchangeable. A *federation execution* is the actual operation, over time, of a set of federates interconnected by an RTI.

In principle, a FOM exists only for the duration of the “specific objective”, typically a scheduled exercise. When that is the case, it does indeed make sense to generate the FOM as the intersection of the SOMs of the federates involved. However, in practice FOMs tend to lead a continuing existence of their own, either because the exercise is repeated at regular intervals, or because an all-inclusive FOM is desired in order to avoid having to edit it despite a changing roster of federates. In particular, a FOM greater than the intersection of the *actively* participating federates makes sense when *passive* federates are used to capture (for analysis logs or for after-action reviews, for example) what happens during the federation execution. In such a case, the passive federate needs to be able to subscribe to objects and interactions (see Synthetic Environment, below) that spend their entire lifespan (i.e. are created, managed and destroyed) within a single federate’s purview. Even though no collaborative simulation occurs, the objects of interest must nevertheless appear in the FOM for the passive federate to accomplish its task.

All communication and interaction between the federates goes through the RTI; private direct connections are not allowed. The representations of the objects in the federation execution are all held by the federates: the RTI does not cache the data that transits through it.

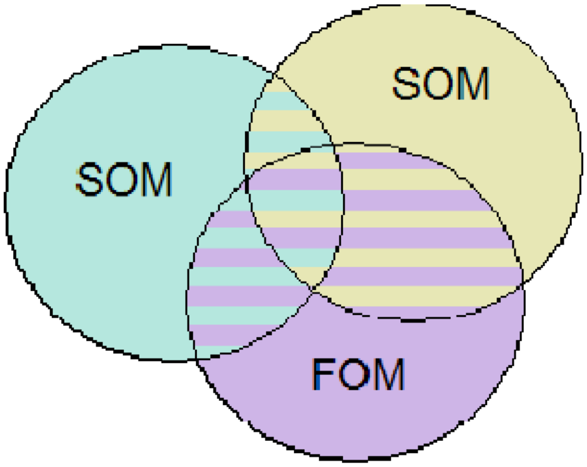

Figure 4. *The intersections of the object models*
The intersections of the simulation and federation object models (SOM and FOM) dictate the possible collaborations. The three-colour area represents the object model understood by both simulations and the federation; only those objects are susceptible to collaborative simulation by the simulations during the federation execution.

Synthetic Environment

The HLA synthetic environment is populated by durable entities called *objects*. In a military context, the simulation objects are usually representations of real-world objects: soldiers, vehicles, buildings and so on. More abstract objects are possible and indeed often desirable. For example, a simple tactical constructive simulation could have a "Weather" object, which could be little more than a holder for a handful of meteorological parameters such as temperature, humidity, wind speed and wind direction. Other objects could represent more abstract concepts, such as groups of entities (organized or not): a military unit or a crowd of protesters.

The object models define *classes* of objects, which are nothing more than a collection of *attributes* that serve to define the object's state. In other words, object classes are *data structure templates*. In object-oriented software design, objects are normally defined as encapsulations of data and operations (*methods*); in HLA, object classes have no methods: they are defined entirely by their identifying attributes. The behaviours and operations that affect the values of HLA object attributes are kept resident in the federates. The HLA supplies the `HLAobjectRoot` class, from which all other object classes descend in hierarchical fashion. Subclasses inherit their superclass's attributes, naturally.

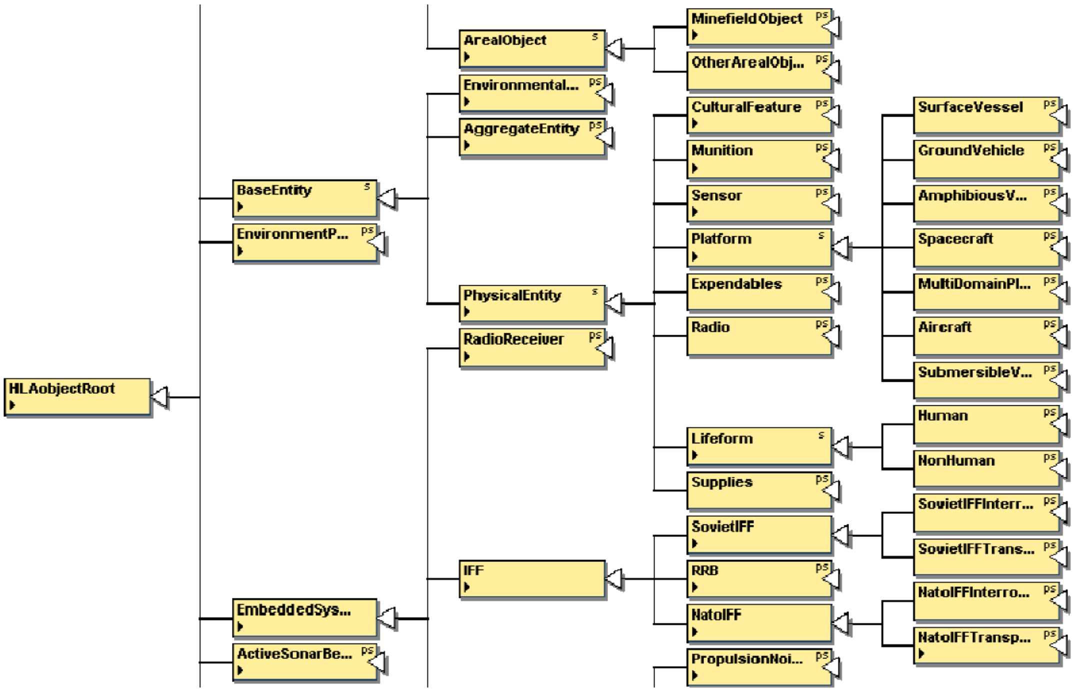

Figure 5. *A subset of the RPR-FOM version 2.0 object class hierarchy*
The attributes are not shown.

During a federation execution, *instances* of the various object classes may be created and deleted by each federate. A federate declares its intention to *publish* and *subscribe to* an object class's attributes (or a subset thereof). When an object instance is created by a federate, the RTI considers that federate as *owning* the instance attributes that it publishes for that class (any remaining attributes are unowned). Ownership of an instance attribute means the owner is responsible for keeping that instance attribute's value up to date, and for supplying that value when it is requested by the RTI. Subscribers *discover* object instances when they are pertinent to their subscription interests, and may, as needed, request that the RTI supply them with the instance attribute values. The RTI truly earns its title of middleware in this circumstance, since all it does is request the values from their respective owners and then dispatch the owners' subsequent value update.

The RTI also mediates ownership transfers between federates. Divestiture of an owned instance attribute can be initiated by the owning federate with varying degrees of assertiveness (If Wanted, Negotiated and Unconditional) or it can be requested by the RTI. Conversely, acquisition of an unowned instance attribute may be requested by the federate with varying degrees of forcefulness (If Available, Negotiated) or it can be offered by the RTI. The section entitled Ownership Management (below) discusses this delicate matter in detail.

Interaction is a concept closely related to the object. Interactions are also described as a hierarchy of classes, descending from `HLAinteractionRoot`. Their attributes are called *parameters*, and the key difference is that instead of creating instances, the federates send *occurrences*. Interactions have no duration: they are created at a given instant, distributed like an object instance attribute update, and then cease to exist. They are meant to represent simulation events such as a lightning flash or a direct-fire engagement. Note that SOMs can disagree on what should and should not be an interaction. Let's take the example of a burst of machine gun fire aimed at an infantry platoon. A simpler simulation would likely model this direct-fire engagement as an interaction, whereas a more detailed simulation could choose to create object instances for each bullet.

Despite their name, interactions don't necessarily involve more than one object instance. A FOM could very well include interactions which are nothing more than running commentaries, destined for eventual consumption by event loggers. For example, an event could be designed that corresponds to the decision by one entity to engage another. This "event" has no immediate physical consequences since it occurs "inside the head" of the entity, and could be of interest only while debugging the entity's target selection algorithm.

Each simulation is free to have object models of varying degrees of detail. Indeed, a sizable part of the federation development process (FEDEP) consists of deciding what level of detail is required and which federate is most suited to the task, as well as reconciling object model differences. To facilitate this process, the Real-time Platform Reference FOM (RPR-FOM) is published by the Simulation Interoperability Standards Organization (SISO). SISO-STD-001-1999, *RPR-FOM v1.0* ([26] SISO 1999a, [27] SISO 1999b) captures the functionality of DIS (IEEE 1278.1-1995), and facilitates interfacing a DIS simulation with an HLA federation. RPR-FOM version 2.0 is intended to add the functionality of DIS 2.0 (IEEE 1278.1a-1998) and to update version 1.0 to the IEEE 1516 HLA standard; it is in its seventeenth draft as this is being written ([28] SISO 2003). RPR-FOM version 3.0 is in early draft form and is intended to include features that were originally considered for DIS 3.0 (now abandoned).

A federate could subscribe to an object or interaction class for which there is no publisher; if another federate publishes a superclass of the subscribed class, that is what the first federate will discover. In that sense, HLA is *polymorphic*. All it really means is that you may not get all of the attributes or parameters you subscribed to, since successive subclasses can only differ by the monotonic accretion of attributes/parameters.

Dimension rounds out the set of key HLA concepts. It will be discussed in the section on data distribution management below.

HLA Interface

The application programming interface between a federate and an HLA RTI consists of two software objects: the RTI Ambassador and the Federate Ambassador. The RTI Ambassador instance is supplied by the RTI and exposes a number of methods, called *services*, to the federate (documented in IEEE 1516.1-2000). The federate sends “commands” to the RTI by invoking the RTI Ambassador services. Some services return a value immediately (a Boolean, an attribute handle set, etc.) but most respond asynchronously through the Federate Ambassador. The IEEE 1516 specification, unlike the older specifications (1.3 and predecessors), does not prescribe how the RTI Ambassador instance is to be procured. This allows multiple RTIs to cohabit in the same name space, but it does mean a federate application will probably need a thin adaptor class in order to be able to fetch whichever RTI is installed without needing to be recompiled.

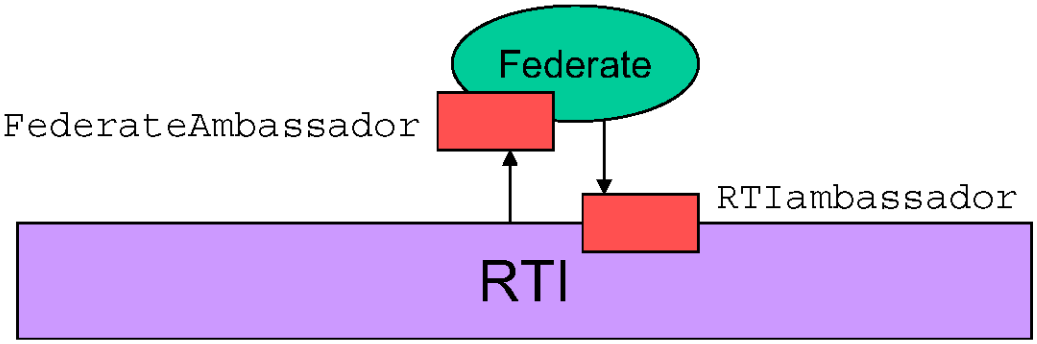

Figure 6. *The interfaces between a federate and the HLA RTI*
The RTI supplies the RTIambassador; the federate must supply a compliant FederateAmbassador.

The Federate Ambassador instance, on the other hand, is supplied by the federate and must implement a specific set of methods (also documented in IEEE 1516.1-2000). The RTI communicates with the federate by invoking the Federate Ambassador methods, called *callbacks*. None of the Federate Ambassador methods return anything to the RTI; the latter expects normal retroaction to occur through RTI Ambassador services, although the Federate Ambassador is expected to throw a variety of exceptions if something is amiss.

The rest of the HLA package consists of a number of classes that define the arguments to the services and callbacks (handles, factories, sets, maps, lists, etc.), as well as the exceptions that they may throw.

The interfaces are specified in terms of services (methods), designators (names and handles) and abstract data types only. The mappings to specific programming languages are supplied in three annexes, covering respectively Ada 95, C++ and Java. The mapping used by a given federate has no consequences on the rest of the federation; for example, a designator encoded using one mapping will be decodable using any other mapping. Since the JACK Agent Language is an extension of Java, we naturally chose to restrict ourselves to Java in what follows.

HLA Services

For convenience, the HLA interface methods are grouped into seven *service groups,* which we will discuss in varying degrees of detail below.

Federation Management

These services deal with the creation, dynamic control, modification, and deletion of a federation execution. Create/Destroy Federation Execution are used to create and destroy federation executions. Join/Resign Federation Execution are used by the federate to join a federation execution and withdraw from it when the execution ends.

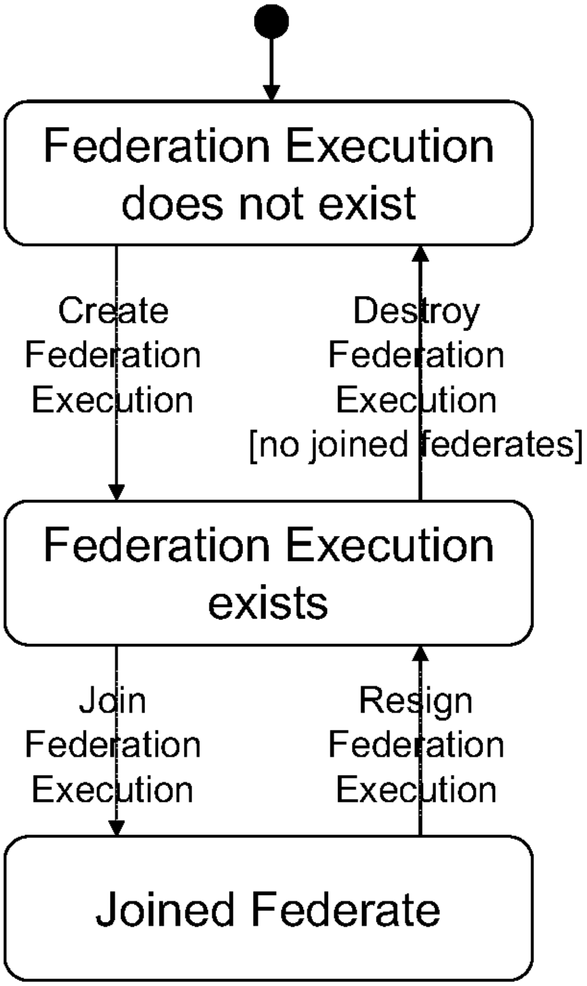
Federation Execution does not exist
Create Federation Execution
Destroy Federation Execution [no joined federates]
Federation Execution exists
Join Federation Execution
Resign Federation Execution
Joined Federate

Figure 7. *The global federate states and their transitions*
This diagram and the following ones use the ([29] Harel 1987) statechart notation and are derived from the HLA IEEE 1516 state diagrams. The dot is the initial state. The bracketed term is a Boolean guard expression; here it shows the federation execution may be successfully destroyed only if there are no joined federates.

Synchronization points may be declared by the Register Federation Synchronization Point service. Optionally, knowledge of the synchronization point's existence can be restricted to a subset of the joined federates. The RTI responds with either a Synchronization Point Registration Succeeded or a Synchronization Point Registration Failed callback (the latter includes a reason for failure parameter, because the second form of the Register Federation Synchronization Point service can fail in two distinct ways). The semantics of the synchronization points are documented in the FDD but the RTI does not (indeed cannot) enforce them. A typical use would be a "StartingLine" synchronization point (to use a racing metaphor). As federates join the federation execution and complete their initialization process (which may include interactions between the federates, mediated by the RTI), they would be advised by the RTI of the synchronization point's existence through the Announce Synchronization Point callback, and would be expected to eventually invoke the Synchronization Point Achieved service. Once all required federates have thus acknowledged the synchronization, the RTI announces this state of affairs to each federate through the Federation Synchronized callback, in this case firing the "starting gun." Once the Federation Synchronized callbacks have all been issued, the synchronization point ceases to exist (and may therefore be registered anew).

Federation Synchronization points can also be used whenever some form of synchronization is desirable between multiple joined federates. They can be used to let the RTI arbitrate potential race conditions between federates. Whenever synchronization is required between the multiple threads of an application, programming languages or frameworks provide a variety of synchronization and exclusion classes and mechanisms, variously named *semaphores*, *mutexes* (contraction of "mutual-exclusion"), or *monitors*. In broad terms, the protected object or block of code has an associated *lock* which can be owned by only one thread at a time. When a race condition occurs, one thread succeeds on its lock operation while the others block on it. When the winner concludes the protected block and relinquishes the lock, the system awards it to one of the blocked threads, and so on.

The synchronization services can mimic this. Obtaining a lock corresponds to the successful registration of a synchronization point: if the operation succeeds, the federate "has the lock." The other federates are expected to achieve the synchronization as soon as it is announced to them (acknowledging the lock). Other federates that were simultaneously attempting to register the lock (presumably they would not try if they were already aware of the lock's existence) are expected to put themselves in whatever wait mode is appropriate. The lock's owner relinquishes the lock by achieving the synchronization in its turn (most likely it will be the last federate to do so, but this is not a requisite). When this occurs, the RTI invokes Federation Synchronized for all federates, which signals that the lock has been freed up (i.e. the synchronization point no longer exists). By varying this pattern slightly, semaphores can also be mimicked (e.g. announcement of the synchronization point's existence is the signal being awaited).

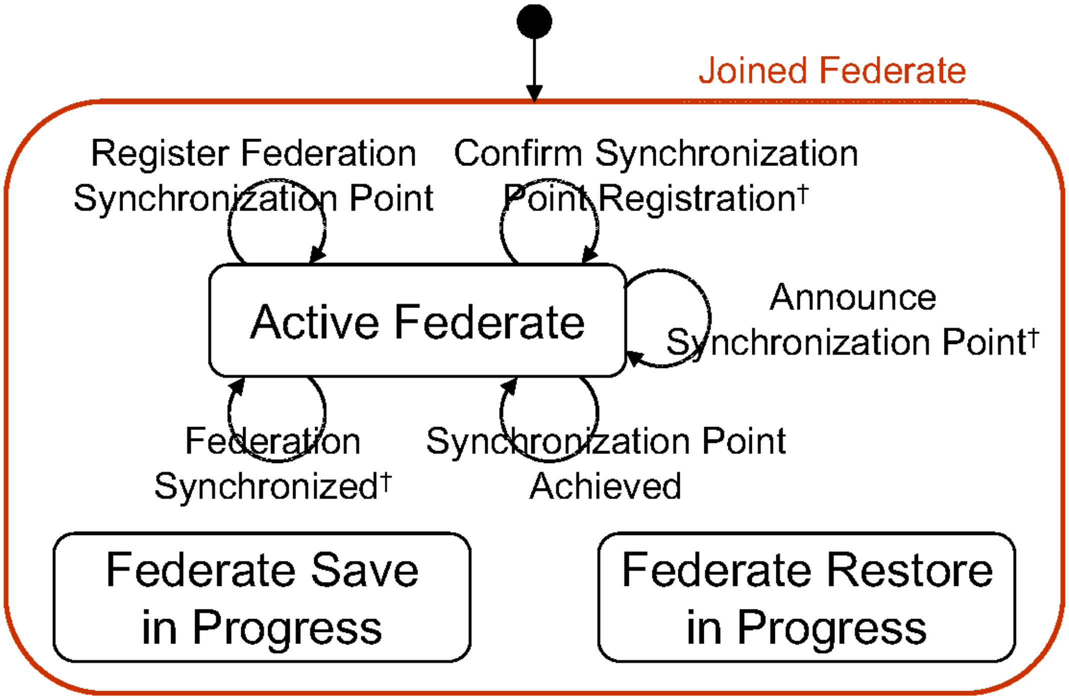
Joined Federate
Register Federation Synchronization Point
Confirm Synchronization Point Registration†
Active Federate
Announce Synchronization Point†
Federation Synchronized†
Synchronization Point Achieved
Federate Save in Progress
Federate Restore in Progress

Figure 8. *The joined federate states*
Transitions marked with a dagger (†) are FederateAmbassador callbacks. The synchronization point services do not change the state of the federate itself, although they do change the federation state.

Federation saves complete this set of services. A federation save stores a complete description of the federation execution in such a way that the federation execution may be restored later. Saves are identified by a label, and can be generated at an optional specific logical time. It can be presumed to consist of a set of files distributed between the joined federates on the one hand, and the RTI on the other (the form the storage takes is left as an implementation issue for the RTI and federates). Besides the save label, the RTI stores the number of federates joined at the time the save is created, and the *types* of the various joined federates (these types are simply labels supplied by the federates when they join the federation execution; their semantics are left to the federation). Unlike synchronization points, saves always affect the entire set of joined federates. A federate is expected to use the save label, the name of the federation execution (and, implicitly, the FDD), its joined federate designator and its federate type to distinguish the saved state information.

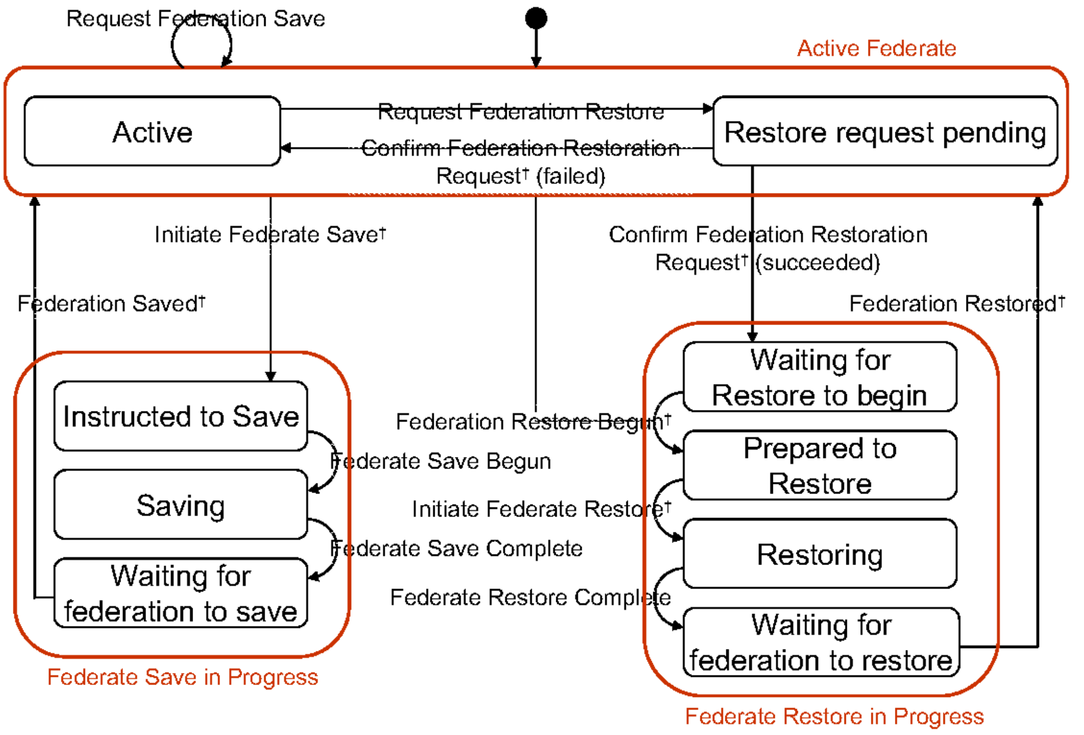
Request Federation Save
Active Federate
Active
Request Federation Restore
Confirm Federation Restoration Request† (failed)
Restore request pending
Initiate Federate Save†
Confirm Federation Restoration Request† (succeeded)
Federation Saved†
Federation Restored†
Instructed to Save
Federate Save Begun
Saving
Federate Save Complete
Waiting for federation to save
Federate Save in Progress
Waiting for Restore to begin
Federation Restore Begun†
Prepared to Restore
Initiate Federate Restore†
Restoring
Federate Restore Complete
Waiting for federation to restore
Federate Restore in Progress

Figure 9. *The federate save and restore states*
Most useful work is done in the Active Federate states.

Any federate may Request Federation Save. The RTI sends the Initiate Federate Save callback to each federate, including the requestor. Each federate then complies by invoking Federate Save Begun and later Federate Save Complete (specifying if it was successful or not). As soon as the federate enters one of the “Federate Save in Progress” states, the RTI withholds most callbacks and refuses to accept the overwhelming majority of the various service invocations from the federate—those that would change the state of the federation in some way. As the save progresses, a federate may Query Federation Save Status, to which the RTI responds with the Federation Save Status Response callback. Eventually the RTI announces to the federates that the save is complete (successful or not) through the Federation Saved callback, and normal execution can then resume.

The reverse of the save process is the *federation restore* process. This begins with a Request Federation Restore, which the RTI acknowledges with the Confirm Federation Restoration Request callback (specifying if it was successful or not). Using the Federation Restore Begun callback, the RTI signals each federate (including the requestor) that it has been put in the "Federate Restore in Progress" state, which restricts federate activity just like during a federation save. Note that the requestor enters the suspended state as soon as it receives confirmation of the request. Next, the RTI requests of each federate that it begin to restore its state as previously saved, using the Initiate Federate Restore callback. The federate signals the completion of its restore process through Federate Restore Complete (specifying if it was successful in doing so or not) and may Query Federation Restore Status, receiving a Federation Restore Status Response callback in response. Finally, the RTI advises each federate of its return to normal operation through the Federation Restored callback.

Because federation saves are implementation-specific, there is no requirement that a save created by one vendor's RTI be restorable by another vendor's RTI. Also, federates that share the same federate type must be able to handle each other's save documents. For example, if federates A, B, and C were all of the same type when the save was created, when the RTI processes a restore request the only guarantee is that it will assign each of the federates one of those three roles (see Figure 10). Federate A could therefore end up restoring its own save data, or B's or C's. This strongly suggests a certain level of storage sharing for save/restore.

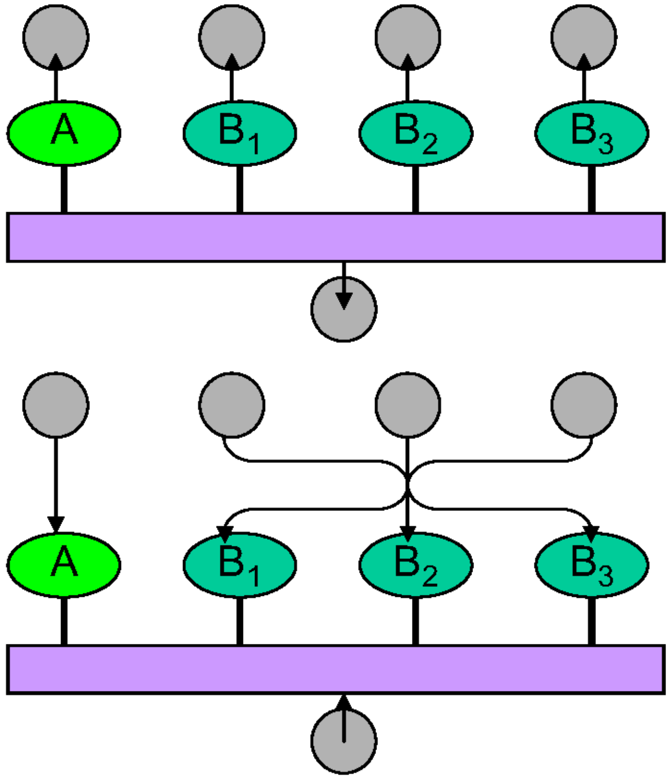

Figure 10. *Interchangeability of federates of the same type*
Top: the federation is saved and the save data is spread between the stores (in grey). When the restore occurs (bottom), the federate instances B_1 through B_3, all of the same type, may be assigned any of each other's original roles.

Declaration Management

These services deal with the publication of and subscription to object and interaction classes. This is accomplished by the [Un]Publish/Subscribe Object Class Attributes and [Un]Publish/Subscribe Interaction Class services. Note that publication is at the object class attribute level in the former case, but at the interaction class level in the latter: you cannot subscribe to or publish just a subset of an interaction's parameters.

The only (optional) RTI callbacks are Start/Stop Registration For Object Class and Turn Interactions On/Off. These are known as the Object Class and Interaction Relevance Advisories, respectively. They are used to allow a federate to more intelligently manage its publication activities. In effect, the Object Class Relevance Advisory lets the federate know whether or not any other federates are actively subscribing to a published set of object class attributes. If there are none, there is no point in registering new object instances (or sending new interactions). This can help with federation execution performance.

A small subtlety here is the possibility of *passive subscriptions*; these do not trip the advisories and are designed to allow special federates like loggers or viewers, which do not contribute actively (i.e. do not own anything or send interactions), to join a federation execution freely without modifying its behaviour.

Object Management

These services deal with the registration, modification, and deletion of object instances and the sending and receipt of interactions. The bulk of the "action" of a federation execution is expected to occur here.

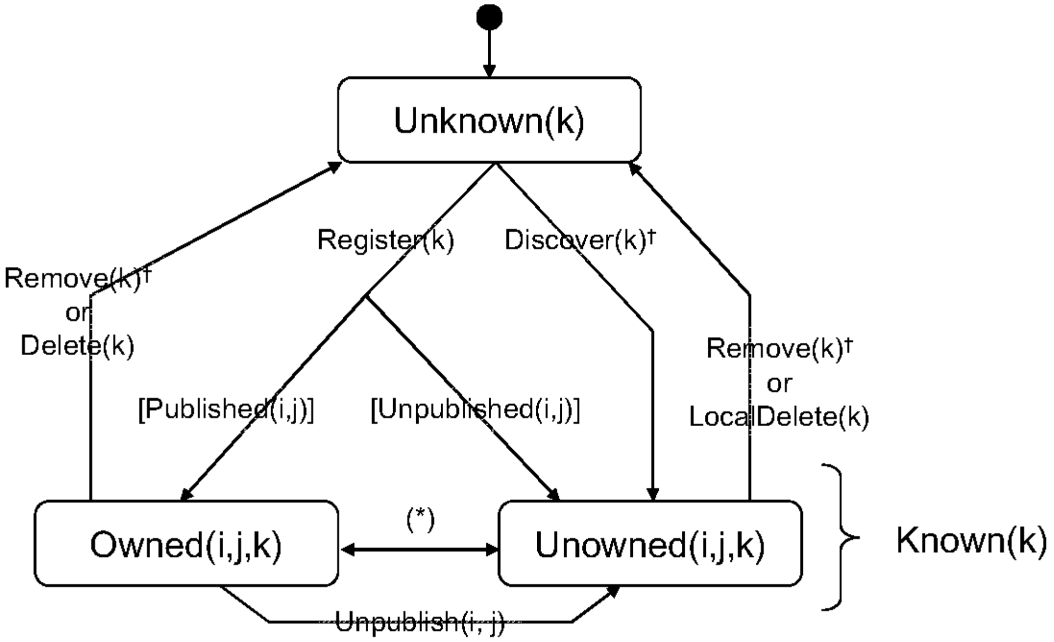

Figure 11. *Known/Unknown transition state diagram*
Part of the state diagram for object instance attributes, focusing on the known/unknown transitions. The details of the owned/unowned transitions (*) are given in Figure 12. Here i *stands for an object class,* j *for an object attribute and* k *for an object instance.*

The first service in this group is Reserve Object Instance Name, to which the RTI responds through the Object Instance Name Reserved callback. All object instances, as they are registered, are given federation-wide unique names automatically by the RTI. The name reservation service allows a federate to reserve a name, something which is typically done for special object instances that have been deemed necessary for the federation execution design.

Next is Register Object Instance, which may trigger Discover Object Instance at other federates. This is how object instances are injected into the federation execution. The converse service is Delete Object Instance, which will trigger Remove Object Instance at the federates that had previously discovered the object instance. A non-owning federate can also invoke Local Delete Object Instance, whose purpose is simply to "forget" about the object instance. This could be because it has gone out of scope and is no longer of any interest to the federate, or it could be because the federate wants to shift its subscription interests for already-discovered object instances (e.g. an object was previously discovered as one of its superclasses and the federate wants to rediscover it as a more specific subclass, or vice versa).

Then we have Update Attribute Values, which is how an owning federate apprises the RTI of the new values of instance attributes. The update policy for each class attribute is documented in the FDD but is not enforced by the RTI. The updated values are distributed to the subscribing parties through the Reflect Attribute Values callback. A subscriber may invoke Request Attribute Value Update, which will lead the RTI to prompt the publisher with a Provide Attribute Value Update callback. Note that a request for a value update for an unowned instance attribute won't be answered, since no custodian of the instance attribute value exists. This is because the RTI does *not* cache the "last known value."

Interactions, because of their transient nature, combine Register and Update into a single service, Send Interaction. Subscribers receive the Receive Interaction callback.

The RTI supports two built-in *transportation types*: "reliable" and "best effort", typically mapped to Transmission Control Protocol/Internet Protocol (TCP/IP) and User Datagram Protocol (UDP), respectively. New ones may be defined if needed. The transportation type is specified by the FDD and may be changed at the instance attribute or interaction class level through the Change Attribute/Interaction Transportation Type services.

Finally, there are two sets of advisories associated with this service group. They serve to let publishers and subscribers know whether or not they have counterparts in the federation. Like the declaration management advisories, they serve to let federates optimise their use of bandwidth—there is no point in sending instance attribute updates regularly if there are no subscribers currently listening. The Attribute Relevance Advisory causes the Turn Updates On/Off For Object Instance callbacks at the publisher. Its converse, the Attribute Scope Advisory, causes the Attributes In/Out Of Scope callbacks at the subscriber. A published attribute goes out of scope if it has no subscribers; a subscribed attribute goes out of scope if it has no publisher (i.e. is unowned). This notion of *scope* is of limited usefulness until the data distribution management services are considered, as we will see later.

Ownership Management

These services deal with the transfer of ownership of instance attributes among joined federates. HLA departs from conventional object-oriented design in allowing the attributes of an object instance to be owned in a distributed fashion, rather than being under the exclusive responsibility of the object owner. This is a powerful feature that greatly facilitates the cooperative modelling of objects.

The root object, `HLAobjectRoot`, has just one attribute, `HLAprivilegeToDeleteObject`, inherited by all HLA objects. This attribute has no value (content); the only thing that matters is which federate owns it. The federate that owns this attribute "owns" the object instance, in the sense that it is the sole federate allowed to delete the object instance.

To give a simple example of what attribute ownership means, consider a missile ordnance object. Before the missile's launch, it is attached to its launcher (e.g. under the wing or in the bomb bay of an aircraft, in a ship's missile storage compartment, in a man-portable launch tube, etc.). HLA ownership management allows the missile's geographical coordinates attributes to be the responsibility of (to be owned by) whichever simulation moves the launcher about. It is only once the missile is launched that ownership of these attributes needs to be transferred to the federate responsible for the missile's flight.

HLA defines the Management Object Model (MOM), a small hierarchy of objects and interactions which are part of every FOM. These are owned by the RTI and represent the federates and their relation to the RTI; they are mostly used for network oversight, performance tuning, and troubleshooting. The RTI never accepts ownership of anything else, and never relinquishes ownership of any part of the MOM.

Ownership is crucial within an HLA federation, because the owner of an object instance attribute is the sole custodian of its value. While an attribute is unowned, its value cannot be obtained from the RTI: each federate is left with its locally cached "last known value", if any. Ownership is also tied to discovery: if an object instance ends up an *orphan* (that is to say, none of its attributes are owned by any federate *and* it is currently not known by any federate), it cannot be discovered at all.

Ownership management is a delicate process, as the associated state diagrams show (see Figure 12 and Figure 13). A federate starts off owning all of the *published* attributes of an object instance it registers (a minimum of one attribute). It can *divest* itself of ownership in four ways: through the Unconditional Attribute Ownership Divestiture service, the Negotiated Attribute Ownership Divestiture service, the Attribute Ownership Divestiture If Wanted service, and by unpublishing the owned object's class. Conversely, it may *acquire* ownership in two ways: through the Attribute Ownership Acquisition service, or the Attribute Ownership Acquisition If Available service.

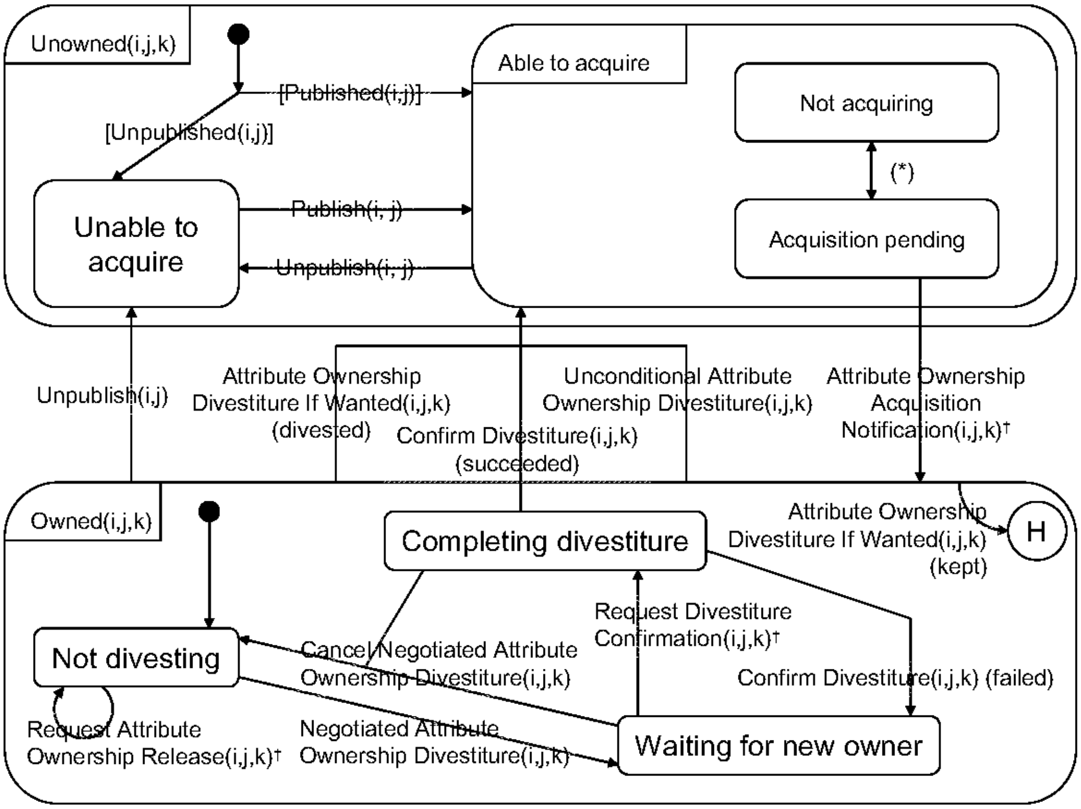
Unowned(i,j,k)
[Published(i,j)]
[Unpublished(i,j)]
Able to acquire
Not acquiring
(*)
Acquisition pending
Unable to acquire
Publish(i, j)
Unpublish(i, j)
Unpublish(i,j)
Attribute Ownership Divestiture If Wanted(i,j,k) (divested)
Confirm Divestiture(i,j,k) (succeeded)
Unconditional Attribute Ownership Divestiture(i,j,k)
Attribute Ownership Acquisition Notification(i,j,k)†
Owned(i,j,k)
Completing divestiture
Attribute Ownership Divestiture If Wanted(i,j,k) (kept)
H
Request Divestiture Confirmation(i,j,k)†
Not divesting
Cancel Negotiated Attribute Ownership Divestiture(i,j,k)
Confirm Divestiture(i,j,k) (failed)
Request Attribute Ownership Release(i,j,k)†
Negotiated Attribute Ownership Divestiture(i,j,k)
Waiting for new owner

Figure 12. *Owned/Unowned transition state diagram*
Part of the state diagram for object instance attributes, focusing on the owned/unowned transitions (the asterisk in Figure 11). The circled H *indicates the historical state (meaning the service may be invoked from any one of the inner states and returns whence it was invoked). The details of the Not acquiring/Acquisition pending transitions (the asterisk here) are given in Figure 13.*

The Attribute Ownership Acquisition If Available service is “non-intrusive” (like a passive subscription) and is immediately resolved by the RTI based on current ownership availability. The requesting federate receives an Attribute Ownership Acquisition Notification for the instance attributes acquired and an Attribute Ownership Unavailable for the others.

The Attribute Ownership Acquisition request, on the other hand, puts the federate in the “acquiring” state (with respect to the specific instance attribute), whence it may return through the Cancel Attribute Ownership Acquisition service. The RTI acknowledges this cancellation through the Confirm Attribute Ownership Acquisition Cancellation callback. This form of acquisition is “intrusive” (like an active subscription) because the RTI will prompt the owner (if not already divesting) through a Request Attribute Ownership Release callback. The Attribute Ownership Unavailable callback does not occur in this context, but several Attribute Ownership Acquisition Notifications may occur depending on the number of previous owners involved and their ownership release schedules. Note that the Attribute Ownership Acquisition If Available service will not return the federate from the “acquiring” state since it is a weaker request than the outstanding Attribute Ownership Acquisition.

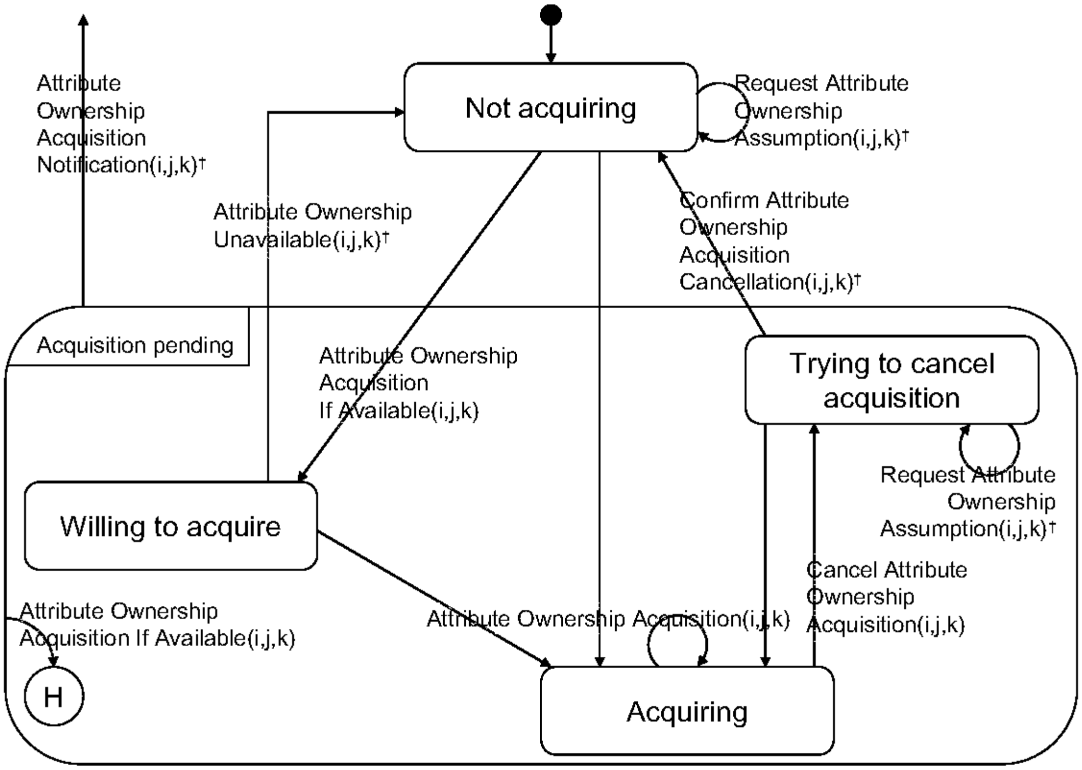
Not acquiring
Request Attribute Ownership Assumption(i,j,k)†
Attribute Ownership Acquisition Notification(i,j,k)†
Attribute Ownership Unavailable(i,j,k)†
Confirm Attribute Ownership Acquisition Cancellation(i,j,k)†
Acquisition pending
Attribute Ownership Acquisition If Available(i,j,k)
Trying to cancel acquisition
Request Attribute Ownership Assumption(i,j,k)†
Willing to acquire
Cancel Attribute Ownership Acquisition(i,j,k)
Attribute Ownership Acquisition If Available(i,j,k)
Attribute Ownership Acquisition(i,j,k)
H
Acquiring

Figure 13. *Not Acquiring/Acquisition Pending transition state diagram*
Part of the state diagram for object instance attribute ownership, focusing on the Not acquiring/Acquisition pending transitions. The left-hand acquisition pending state represents non-intrusive acquisition, whereas the right-hand states represent intrusive acquisition.

When an Unconditional Attribute Ownership Divestiture occurs, the federate immediately ceases to own the instance attribute. It may become unowned, or the RTI may immediately grant ownership to some other federate that had previously requested Attribute Ownership Acquisition. If there are no such “acquiring” federates, other publishers are prompted by the RTI through the Request Attribute Ownership Assumption callback. This is the only circumstance under which the RTI will actively pester the federates to assume ownership.

With the Negotiated Attribute Ownership Divestiture service, the federate puts itself in the “divesting” state, whence it may return through the Cancel Negotiated Attribute Ownership Divestiture service. If other federates are already in the “acquiring” state (failing that, the RTI will prompt potential new owners as in the unconditional case), the divesting federate receives a Request Divestiture Confirmation callback. It then confirms the transfer of ownership by invoking the Confirm Divestiture service. The federate can also leave the “divesting” state by unpublishing the attribute or by divesting it in one of the other two means mentioned earlier.

With the Unpublish Object Class Attributes service, the federate immediately ceases to own any attribute of every single instance of the unpublished object class; unlike Unconditional Attribute Ownership Divestiture, the RTI will *not* offer ownership to eligible federates other than those actively pursuing acquisition.

Ownership management is rounded out by the Query Attribute Ownership service, to which the RTI responds through an Inform Attribute Ownership callback. A simpler form of the query is the Is Attribute Owned By Federate service, which returns a Boolean immediately.

Time Management

These services and associated mechanisms provide a federation execution with the means to order the delivery of messages (service and callback invocations) throughout the federation execution according to a *logical time scale*. The federation execution has a single global “clock” which tracks the federation time. This time is advanced in cooperative fashion by the various federates, and serves to preserve causality. The only way the federation clock may be turned back is through the save/restore facility. The description of the services that make up this group will be kept to a minimum here, as these services were not the focus of this work and have been better described by others (see for example [30] Fujimoto and Weatherly 1996, [31] Carothers et al. 1997, [32] DISTI 1997).

Messages are delivered according to two *ordering types*: receive order and time-stamp order. The former ordering type is “timeless” in the sense that it ignores logical time considerations and is delivered as soon as possible in real time. Similarly, federates may be *time-regulating*, *time-constrained*, both or neither (this status can change freely during execution). Time-regulating federates are the only ones sending time-stamped messages, whereas time-constrained federates are those receiving time-stamped messages. The actual ordering type of a sent or received message depends on the status of the involved federates, the message’s preferred ordering type, and the specific variant of the service used (i.e. whether or not a time-stamp argument is provided).

Apart from time management services, relatively few services can accept a time-stamp argument: Request Federation Save, Update Attribute Values, Send Interaction and Delete Object Instance. Note in particular that ownership management is not time-stamped, which means precautions must be taken to avoid odd situations where instance attributes are, for a given logical time, owned by either no federate or several federates.

In part to allow optimistic simulations (where some of the federates anticipate events by processing them ahead of time so that the results of their computations are readily available when the events do occur), the time management services provide an *event retraction* capability: within some logical time constraints, a time-regulating federate may send messages time-stamped in the federation’s future and later Retract them. Retracted events will either be simply removed from other federates’ queues (if not delivered yet) or cause the affected federates to receive a Request Retraction callback.

A key concept of HLA time management is the federate *lookahead*. This is a span of logical time, extending from the federate's current logical time value into the future, within which the federate may not send time-stamped messages. It can be conceived as the "thickness" of the federate's "now", or as the federate's "reaction time." Its purpose is to avoid a variety of time deadlock situations. It is modifiable through the Modify Lookahead service.

A federate signals its intent to move its clock ahead through the Time Advance Request [Available], Next Message Request [Available] and Flush Queue Request services. This switches the federate from the "time granted" state (the normal operating state) to the "time advancing" state. The Time Advance Grant callback completes the process by switching the federate's state back to "time granted."

Federates change their time status with the Enable/Disable Time Regulation/Constrained services. The Enable services are acknowledged by the callbacks Time Regulation/Constrained Enabled (the Disable services automatically succeed, so no acknowledgement callbacks are required). The preferred ordering type of attribute updates and interactions are modifiable through the Change Attribute/Interaction Order Type services. Whether receive-order messages may be received while in the "time advancing" state is controlled through the Enable/Disable Asynchronous Delivery service.

Finally, the federate can query the RTI about a variety of time management parameters through the Query Lookahead, Query Logical Time, Query GALT (greatest available logical time) and Query LITS (least incoming time stamp) services.

Data Distribution Management

These services provide a set of powerful filtering mechanisms allowing the exclusion of irrelevant messages at the instance attribute or interaction occurrence level. Both producers and consumers may restrict their publishing and subscribing distribution *regions* according to a federation-defined set of *dimensions*. The RTI ensures that message delivery occurs only when the two sets of regions actually overlap. An example would be interaction classes that reflect command and control radio traffic: their publication would probably be restricted to a small range (see below) over the frequency dimension (the communication's bandwidth), while an electronic warfare listening post would restrict its subscription to the bandwidth it is currently listening to. Only if the two ranges overlap is an intercept possible.

Each of the federation-defined *dimensions* is an independent axis along which *ranges* may be defined as needed. They are defined by an included lower bound of zero and an excluded upper bound which can be any integer type. Typical examples of dimensions are latitude, longitude, altitude, and broadcast frequency. HLA automatically provides the *default region*, which encompasses all of the defined dimensions in their entire range; in other words, it is the universal nothing-gets-filtered-out filter. Unless data distribution management (DDM) is used to modify object and declaration management services, these are assumed to use the default region.

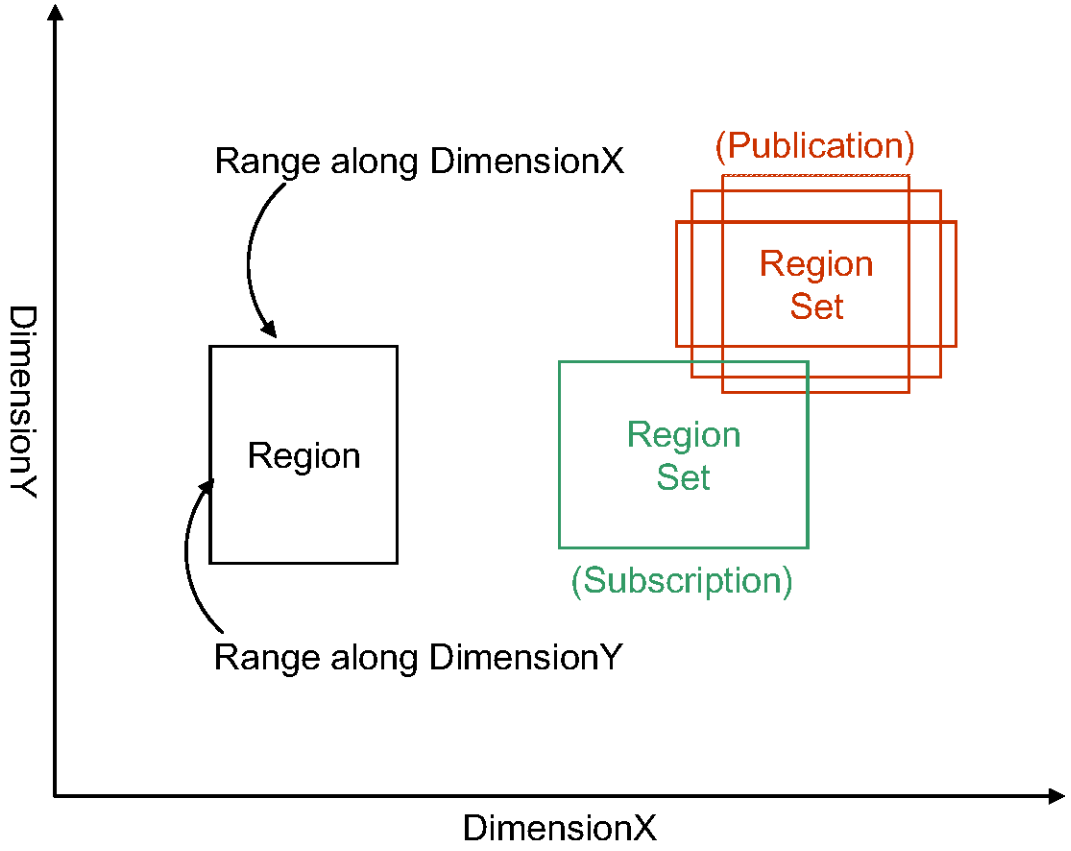

Figure 14. *Dimensions, ranges, regions, and region sets*
Overlapping attribute publication (red) and subscription (green) region sets are also shown.

In the FDD, each object class attribute or interaction may be associated with any number of dimensions, depending on the federation's needs for filtering. This set of dimensions is called the attribute's (or interaction's) *available dimensions*. It is important to realise that an attribute's dimension, in the physical sense, has nothing to do with the DDM dimension. For example, any attribute of a vehicle class that is likely to be of interest to other federates should be associated with the longitude dimension in order to allow spatial filtering, not just the longitude attribute.

Each dimension defines a *default range*, which can be an actual range or an exclusion indicator. Note that a dimension's default range does *not* affect the extent of the default region. Default ranges come into play when realizing regions, as we'll see shortly.

The Create Region service expects as argument a set of *specified dimensions*, and returns a *region template*. The federate's choice of specified dimensions signals to the RTI its intent to specify a range (a single continuous interval) over each of those. Once the bounds have been set for each of the specified dimensions, the Commit Region Modifications service may be invoked to create a *region specification*. The range bounds may be modified later on, again using the Commit Region Modifications service. This allows regions to be dynamically modified as simulated time elapses.

A region template or specification may be deleted using the Delete Region service. Regions that are "in use" (that have been realized, as we'll see below) may not.

Region ownership is *not* transferrable: only the region's original creator federate may delete it, modify it, or use it to send an interaction, or to publish or subscribe to attributes. The Receive Interaction and Reflect Attribute Values callbacks may, if the receiving federate wishes it, include the regions used by the sender. This allows the receiving federate to inspect those regions, possibly in order to create duplicate regions of its own.

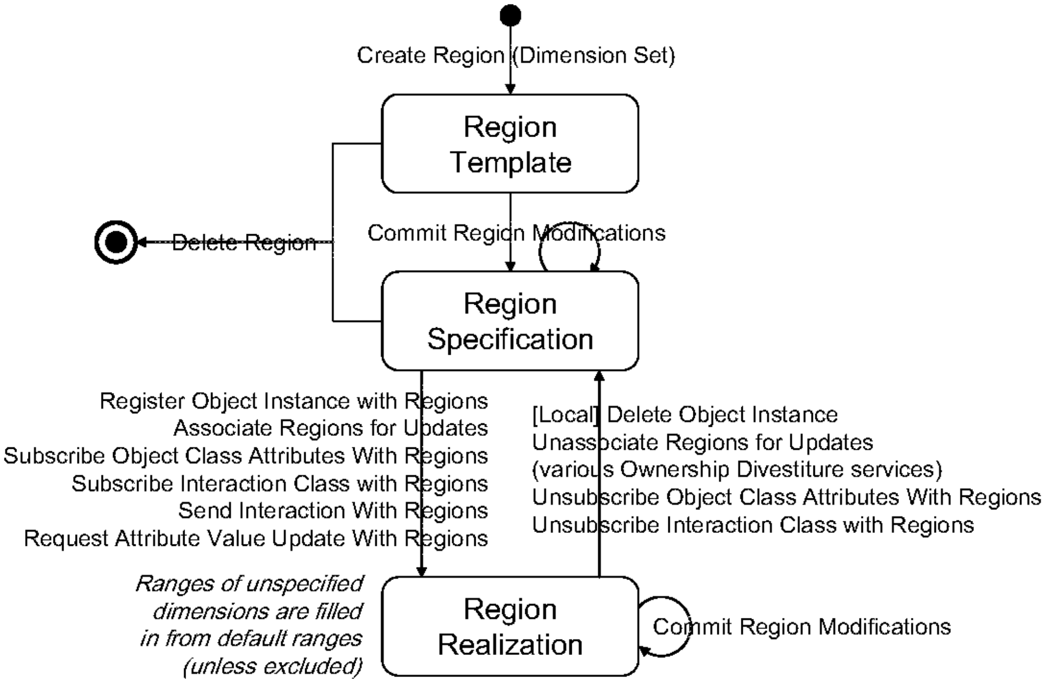
Create Region (Dimension Set)
Region Template
Delete Region
Commit Region Modifications
Region Specification
Register Object Instance with Regions
Associate Regions for Updates
Subscribe Object Class Attributes With Regions
Subscribe Interaction Class with Regions
Send Interaction With Regions
Request Attribute Value Update With Regions
[Local] Delete Object Instance
Unassociate Regions for Updates
(various Ownership Divestiture services)
Unsubscribe Object Class Attributes With Regions
Unsubscribe Interaction Class with Regions
Ranges of unspecified dimensions are filled in from default ranges (unless excluded)
Region Realization
Commit Region Modifications

Figure 15. *Transitions between region templates, specifications and realizations*

Region specifications become *region realizations* when associated with an object instance attribute, an object class attribute or an interaction class. Unspecified dimensions that are members of the available dimensions and that had default ranges are added by the RTI to the region realization. The region's *contained dimensions* is the set of dimensions for which the region defines a range. Note that a given region specification may give rise to a number of different region realizations, depending on the attributes or interactions it is associated with. Note also that federates can designate region realizations only in one instance: during a Reflect Attribute Values or Receive Interaction callback, the `RegionHandleSet` received (if any) consists of copies of the region realizations used by the sender when the attribute value update or interaction was sent. They are read-only, and cease to exist once the callback concludes.

A region cannot be associated with an attribute or interaction if overspecified. That is to say, the region's specified dimensions must be a *subset* of the attribute's (or interaction's) available dimensions.

Figure 16 illustrates the relationships between the various dimension sets described above. The federation defines the outer set, the defined dimensions. A region's specified dimensions and an attribute/interaction's available dimensions are independent subsets of the defined dimensions. For a region to be applicable to an attribute/interaction, however, its specified dimensions must be a subset of the available dimensions, which is what is shown here. The defined dimensions can be subdivided into those dimensions that have a default range (on the right) and those that don't ("excluded" dimensions, on the left). When a region realization occurs, by associating an attribute/interaction with an applicable region specification, the resulting contained dimension set is the one filled in yellow.

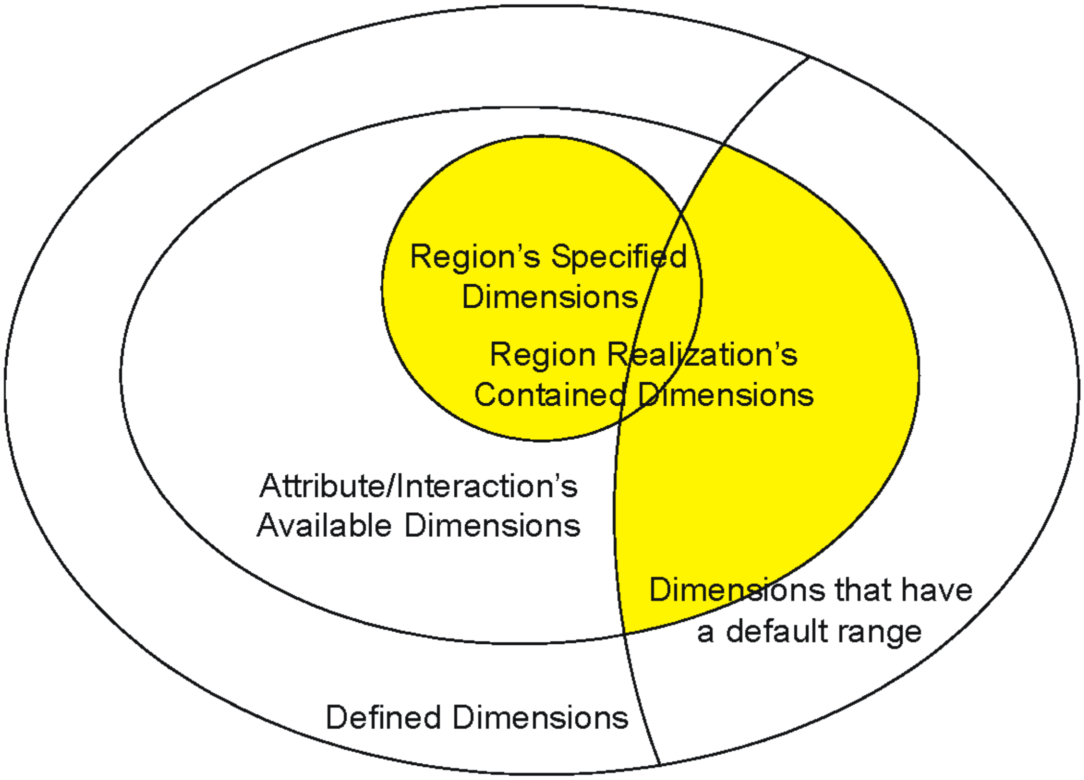

***Figure 16.** Relationship between dimension sets*
A Venn diagram illustrating the relationship between different dimension sets.

The fact that each region defines at most one range over each dimension (thus describing a hypercube of sorts) is quite limitative, which is why publications and subscriptions are defined over sets of regions. As Figure 14 shows (in red), a fair approximation to a two-dimensional circle can be achieved by defining a suitable set of rectangular regions. Region sets can also be used to describe discontinuous (broken up) volumes.

For an interaction to be received, for an object instance to be discovered and for attribute value updates to be reflected, the publication and subscription regions must overlap. Overlap is determined by looking at the publisher's and subscriber's region sets. There is overlap between the sets if at least one publisher's region overlaps one subscriber's region. A given publisher region overlaps a subscriber region only if they have at least one contained dimension in common and if the ranges overlap for each contained dimension common to the two regions.

Figure 17 shows a crude example where a radar has defined a subscription region set that roughly represents its coverage volume using the radar cross-section and easting dimensions (not shown are the northing and altitude dimensions). An aircraft object defines its publication region based on its current position and radar cross-section. When the two region sets do not overlap, the radar federate does not discover the target object and does not have to spend any computation time rejecting the potential detection.

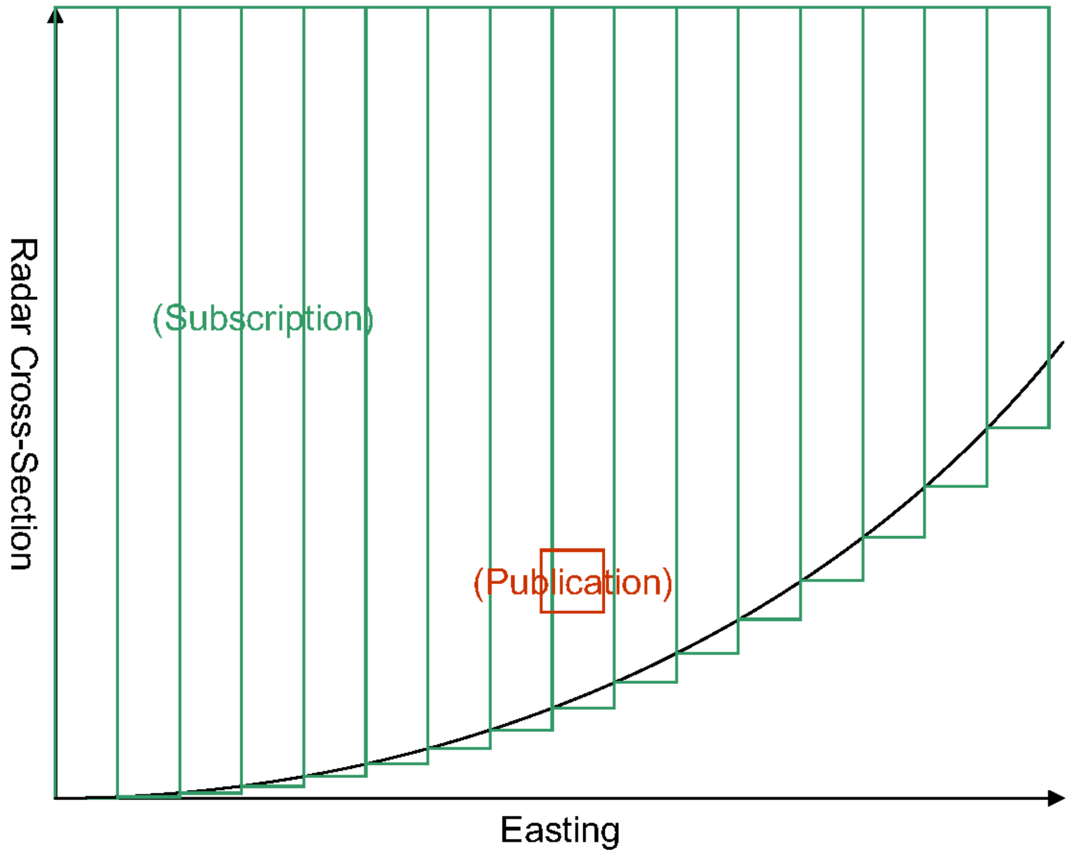

Figure 17. An example of overlapping publication and subscription region sets

Figure 18 shows the converse, where the radar has defined a publication volume using the radiated power and easting dimensions. The aircraft object defines its subscription volume based on its current position and radar warning device threshold. While the two region sets do not overlap, the aircraft federate does not waste time triggering its radar warning device algorithm.

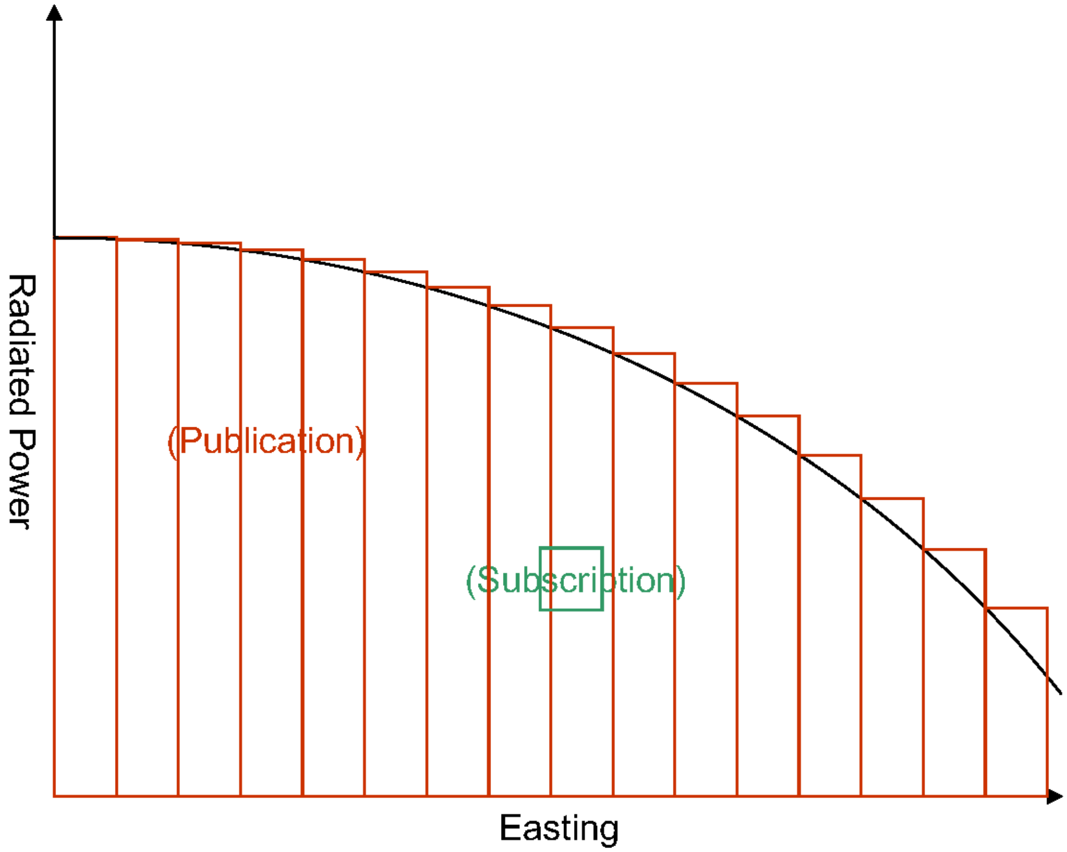

Figure 18. Another example

The declaration management services modified by DDM are the subscription services only. The object management services modified are the object registration, interaction sending and attribute value updating services. The unmodified services behave as if they were using the default region. Whenever an attribute is without any associated regions, it reverts to the default region. Conversely, whenever at least one region is associated with an attribute, it is unassociated from the default region.

Register Object Instance With Regions combines atomically the Register Object Instance and Associate Regions For Updates services, preventing the newly declared object from having its published attributes associated with the default region, however briefly.

The region creation process involves identifying the various handles involved (federates initially know only the names of dimensions, object classes and so on, and must therefore use a variety of Support Services to accomplish this translation), creating a dimension set from the subject's available dimensions, invoking the RTI's Create Region service (a region factory) to create a region having those specified dimensions, and modifying each specified dimension's range as needed. Once this process is complete for each of the regions making up the set, the set is committed through the Commit Region Modifications service, and can then finally be used in an attribute association or subscription sending. The region set may be modified and the changes committed again as necessary; a typical usage is to have various publisher or subscriber "footprints" move over the battlefield's dimensions (detection and coverage volumes, transmission bandwidths, and so on).

Additional regions may be associated and unassociated freely with the attributes. Once a region is no longer needed (that is to say, it is no longer associated with anything), the Delete Region service may be used to get rid of it.

Ownership services are indirectly affected by DDM. Whenever instance attribute ownership is transferred between federates, all of the original owner's region associations lapse. To preserve region associations during ownership transfer, the prospective new owner must, as part of its acquisition process, associate the instance attributes beforehand. These associations have no effect until ownership is actually transferred.

The Attribute Relevance and Attribute Scope advisories are directly affected by DDM, unlike the Object Class Relevance and Interaction Relevance advisories. Whenever an instance attribute publication region set ceases or begins to overlap a subscription region set, the publisher may get the former advisory while the subscriber definitely gets the latter advisory. The publisher's Attribute Relevance advisories are less frequent because they only occur when the status changes between "no subscribers" and "some subscribers"; they are not triggered by changes in the make-up of the set of subscribing federates. The subscriber's Attribute Scope advisories are more frequent but are more specific: only those subscribers that are concerned get them.

Support Services

This service group includes miscellaneous services used to perform name-to-handle and handle-to-name transformations (for object classes and instances, attributes, interaction classes, parameters, dimensions, transportation and ordering types), to change advisory switches (object class relevance, attribute relevance and scope, interaction relevance), to manipulate regions, and to control callback invocations. There is no need to detail these services here except to mention that none of them give rise to callbacks: they all return a result immediately if pertinent. As a general rule, these are the only services that can be invoked from within the federate service thread.

Threads and Process Models

Neither the IEEE 1516 specification nor the HLA 1.3 specification imposes a process model. However, the standard HLA 1.3 implementation, the DMSO 1.3NG RTI, did impose indirectly a single-threaded or asynchronous process model through the `RTIambassador` `tick()` service, which was expected to be "invoked frequently."

There are three possible process models: *single-threaded* (also called *polling*), *asynchronous* and *multi-threaded*. Each specifies when to devote processor time to the local RTI component (LRC). The LRC is the part of the RTI that is responsible for transmitting the federate's service invocations to the RTI at large, for invoking the federate's callbacks in response to RTI messages, and for maintaining the RTI's MOM objects and interactions.

In the single-threaded or polling process model, the federate application is responsible for yielding process time to the LRC through frequent `tick()` invocations. The LRC executes only while the federate waits for the `tick()` invocation to complete. If one considers the federate's code and the LRC's code, execution occurs at only one spot of either one at any time (there is a single "cursor" shared between the two blocks of code).

In the asynchronous process model, there are two concurrent threads that do not intermingle, one for the federate and one for the LRC. The federate is responsible for signaling when it is ready to receive callbacks through the `tick()` invocation. Continuing the preceding allegory, there are two "cursors", one in each block of code (the federate's and the LRC's) and both execute at the same time, except when the LRC's cursor "invades" the federate's code in the body of the latter's callbacks.

In the multi-threaded process model, finally, the LRC runs in its own separate thread (the federate service thread) and can invoke callbacks at any time. There is no `tick()` service. Continuing the allegory, there can be multiple cursors in either block, and the LRC's cursors can freely scan the federate's code at any time.

In HLA 1.3, there was a specific exception, `ConcurrentAccess`, which was thrown when a `FederateAmbassador` callback tried to invoke an `RTIambassador` service. In other words, the LRC accepted `RTIambassador` invocations only when not busy invoking a federate callback. This exception disappeared from the IEEE 1516 specification. However, Pitch pRTI1516, despite being multi-threaded, still behaves in a similar fashion: to ensure consistent sequencing of callback deliveries, each federate is assigned a single federate service thread, and while this thread is busy invoking a federate callback, most `RTIambassador` invocations will cause an `RTIinternalError: Concurrent access attempted to <method name>` to be thrown. This apparently serves to ensure the federate does not undergo any state transitions during a callback; in other words, the RTI treats federate callbacks as atomic.

In any case, making a federate multi-threaded is a tricky matter, since a new federate callback invocation can occur at any point (except during a callback invocation in the Pitch pRTI1516 case). Assertions regarding the federate's state are only valid instantaneously unless precautions are taken. These typically involve setting up various synchronization semaphores in order to protect critical sections of code. But such precautions entail their own share of problems, such as the risk of deadlock.

Synchronization Issues

If we assume a fully multi-threaded RTI, the only thing that we can be sure of is that the callbacks will not occur concurrently: the LRC will evoke each callback in sequence from a single Federate Service Thread. Even that may change in some future RTI implementations. The callbacks themselves are not guaranteed to be received in any particular order (because of network delays, among other things) unless time management is used and several conditions are satisfied at once. For a message to be sent and received in time-stamped order (TSO):

- It must be an attribute value update, object deletion or interaction occurrence (note in particular that ownership negotiations are not susceptible to time-stamping);

- The interaction class or object instance must have a preferred order type of TSO in the FDD (if not, this may be changed, locally to the federate, through the Change Attribute/Interaction Order Type services, on a per-instance basis in the object case);

- The sending federate must be time-regulating;

- The time-stamped form of the service must be used by the sending federate; and

- The receiving federate must be time-constrained.

Sequences of related messages can reasonably be expected to be received in order, either because the RTI implementation makes sure of this, or because the main factor responsible for scrambling message arrival times (i.e. network jitter) is likely to be relatively constant for messages fired in quick sequence from a single origin. For example, an object instance will be Discovered before the related Attribute Scope Advisory is received, and this in turn will precede any Attribute Value Update Reflection.

What is much more likely to occur are mutually unrelated messages, such as interactions, attribute value updates of different object instances, ownership transfers and so on. It is tempting to have the federate devote a thread to each of these unrelated objects, but the overhead associated with constant context switching may be too costly, depending on the application. Some form of message dispatching is clearly desirable. The simplest form has the Federate Service Thread perform crude validation on the messages as they arrive (because the FederateAmbassador exceptions can only be thrown from that vantage point) and then store them in a queue for later processing by another thread or threads.

The queue may be a simple first-in first-out (FIFO) implementation, with a single worker thread grabbing each message in turn, or it could be more sophisticated. One possibility is to sort the messages into separate queues by type (one queue for object discoveries, another for object removals, and so on), allowing various priority schemes to be readily applied. Another possibility is to sort the messages by simulation aspect: there would be one queue for each interaction class, another for each object class, another for each object instance, maybe even another for each object instance attribute. Yet another possibility would be a mixed scheme.

Another important design consideration is the tracking of simulation-related states. The federate needs to know what it has subscribed to, through which regions, and so on. This can be filled in from the various MOM `HLAreport` interactions, or it can be tracked from the federate's end. For example, to find out whether an object instance attribute is subscribed to or not, one can either have a flag attached to the internal representation of that attribute and change that flag as subscriptions are established and withdrawn, or one can send an `HLArequestSubscriptions` interaction, to which the RTI responds with an `HLAreportObjectClassSubscription` interaction for each object class one is subscribed to. Once the one with the correct `HLAobjectClass` is received, its `HLAattributeList` field can be scanned to see if the attribute in question is there or not. As can be seen, considerable overhead is involved in the latter approach, not to mention message traffic. In any case, some state information is missing from the MOM; for example, there is no way to find out whether the subscribed attribute instance of the example is currently in scope or not, nor which regions the subscription is currently being filtered through.

In our Chat Clients, we ended up tracking whether object instances were owned or not, whether they were subscribed to or not (at the class level), whether they were up for divestiture or not, and whether they were in scope or not.

Pitch pRTI1516

According to the DMSO RTI Verification Status Board (https://www.dmso.mil/public/transition/hla/rti/statusboard), the only verified IEEE 1516 implementation is Pitch SA's pRTI 1516. There are only two others currently undergoing verification: MÄK Technologies Inc.'s High Performance RTI and Magnetar Games' Chronos. Other implementations are the open-source XRTI, and CAE Canada is experimenting with a 1516 partial RTI implementation.

Magnetar Games (http://www.magnetargames.com/, formerly Ibis Research, http://www.ibis-research.com/) has been developing FederationX since 1997. Magnetar stands for Metaprogrammable AGent NETwork ARchitecture (http://www.magnetar.org/). The aim is the creation of a research-oriented open-software Collaborative Metaprogramming Framework (CMF) supporting small teams of developers and product designers who endeavour to create rich-media collaborative real-time entertainment and educational software. A core concept of FederationX is that of systems which execute domain-specific metaprograms expressed in eXtensible Markup Language (XML). The metaprogrammable features of systems are built up from FederationX engines. The networking engine is Chronos, an IEEE 1516 implementation using Microsoft's DirectPlay communications layer. The result is a high performance and scalable service supporting large scale peer-to-peer and massive client-server applications. A similar effort is Cybernet Systems Corp.'s OpenSkies RTI, although it is based on the older HLA 1.3 specification.

The eXtensible Run-Time Infrastructure (XRTI; http://www.npsnet.org/~npsnet/xrti/) is an open-source, freely redistributable, Java-based partial implementation of IEEE 1516.1. The aim of the XRTI project is not to compete with commercially available run-time infrastructures, but rather to provide a foundation for research into improvements and extensions to the HLA. It does address a number of themes currently being actively pursued by a number of SISO HLA Product Development Groups (PDGs), such as dynamic FOM modification during federation execution and RTI interoperability.

Because of this lack of real choice, no comparisons could be made, and the decision was made to leave such efforts for a later endeavour. A few comments are nevertheless in order.

The pRTI 1516 package installs and runs without any trouble, although it must be said that no extensive testing was conducted. The Javadoc is essentially non-existent, which is unfortunate. This is a result of the IEEE 1516.1 specification, whose Annex B (the Java API) is normative.

The supplied documentation is meagre; the User's Guide mentions one way to obtain an `RTIambassador` interface for C++ (through the undocumented `hla.rti1516.dlc.RTIambassadorFactory` class's `createRTIambassador(String[])` method). Proximity to the mysterious `hla.rti1516.dlc.RtiFactory` and `hla.rti1516.dlc.RtiFactoryFactory` classes does make one hesitate to use it, however. Later on, the same User's Guide mentions the Java preferred approach, the `se.prti1516.RTI` class's constructor. This is also where one learns of the `se.prti1516.FederateAmbassadorImpl` class.

Inspection of the `prti1516.jar` Java archive file reveals the `hla.rti1516.utility` classes, which seem to be an OMT data type implementation. Alas, without documentation, one hesitates to use them.

We ended up modifying the API files to include extensive Javadoc, mainly for ease of development and reference (Annex B). The Pitch-specific API is, understandably, proprietary and undocumented. There are some classes with tantalizingly significant names, such as `hla.time1516.NormalizedInterval`, `hla.time1516.NormalizedTime`, and `se.prti1516.Encoder` (which seems to implement a few of the OMT datatypes: `HLAinteger32BE, HLAboolean, HLAunicodeString, HLAresignAction, HLAhandle, HLAlogicalTime,` plus the apparently misnamed `HLAlogicalTimeInterval`).

Bugs

IllegalArgumentException not thrown

According to IEEE 1516.1-2000, "12.4.2.15 Constrained set of attribute designator and value pairs: [...] AttributeHandleValueMap [...] extends java.util.Map [...] The values are instances of byte[]; IllegalArgumentException shall be thrown for violations. [...] The implementation shall not accept null mappings."

However, `someAttributeHandleValueMap.put(someAttributeHandle, null)` fails to throw the expected `IllegalArgumentException`.

`ParameterHandleValueMap` (IEEE 1516.1-2000 12.4.2.16 Constrained set of interaction parameter designator and value pairs) suffers from the same bug: it fails to throw `IllegalArgumentException` when `put`ting a `null` value.

Large Dimensions not Handled Correctly

Pitch pRTI1516 (2.3r1 build 101) is unable to read FDDs that define large Dimensions. Specifically, as soon as a dimension's upper bound reaches or exceeds 2^{31} = 2 147 483 648, the `RTIexec` throws an "ErrorReadingFDD: Invalid dimension upper bound" exception. Clearly this is because it internally attempts to convert the upper bound to an `int` instead of a `long` (which is what the API allows). Note that Visual OMT 1516 has no problem dealing with large Dimensions.

Reserved Names Not Rejected

Although IEEE 1516.1-2000 simply states "6.2 Reserve Object Instance Name: [...] The value of the supplied name argument shall not begin with "`HLA`"", the intent seems to be as stated in IEEE 1516.2-2000: "3.3.1 Conventions - Names: [...] c) Names beginning with the string "`hla`", or any string that would match (('`H`'|'`h`') ('`L`'|'`l`') ('`A`'|'`a`')), are reserved and shall not be included in user-defined names. [...] e) A name consisting of the string "`na`", or any string that would match (('`N`'|'`n`') ('`A`'|'`a`')), is reserved [...] and shall not be included as a user-defined name." 1516.2-2000 goes on to list the names for which the rules are applicable, omitting object instances *presumably* because of the document's focus on the OMT.

Pitch pRTI1516 adheres strictly to the 1516.1 definition, and throws an exception *only* for user-defined object instance names beginning with "`HLA`". The fact that it allows names beginning with "`hla`" or "`Hla`", etc., is arguably not a bug per se but rather a potential problem with the interpretation of IEEE 1516.

Orphans Not Deleted

IEEE 1516.1-2000 states: "6.1 Object Management - Overview: [...] Orphaned object instances are unknown by all joined federates and cannot be discovered by any means. [...] Orphaned object instances shall be unreachable by joined federates and should be dealt with appropriately by the RTI."

Unfortunately, the phrase "should be dealt with" is never defined. Arguably, deletion is the appropriate policy: the orphans are undiscoverable, and attempting to register new instances of the same names will fail whether the orphans have been deleted or not. So they might as well be deleted, one may reason. The fact that Pitch pRTI1516 (2.3r1 build 101) fails to "deal appropriately with" (i.e. delete) orphaned object instances is again not a bug per se, but rather an IEEE 1516 interpretation problem.

Integer64Time Missing

The 1516.1 specification states "12.4.2.23: [the] implementers of the Java API shall provide [...] an implementation of the interface `LogicalTime` called `Integer64Time`, [...] an implementation of the interface `LogicalTimeFactory` called `Integer64TimeFactory`, [...] an implementation of the interface `LogicalTimeInterval` called `Integer64TimeInterval`, and [...] an implementation of the interface `LogicalTimeIntervalFactory` called `Integer64TimeIntervalFactory`". No such implementations could be found in the Pitch packages.

Instead, we find `se.prti1516.LogicalTimeDouble`, `se.prti1516.LogicalTimeFactoryDouble`, `se.prti1516.LogicalTimeIntervalDouble`, and `se.prti1516.LogicalTimeIntervalFactoryDouble`, which offer some additional (undocumented) methods. The end functionality is essentially the same, but one nevertheless wonders what else the certification process overlooked.

Federate Service Thread Synchronization Bug

Assume a Java class with subclasses handling the `FederateAmbassador` calls. The `HLAautoProvide` switch is Enabled. In what follows, the code has been simplified to the utmost (try/catch blocks aren't shown, etc.).

In the main thread, at some point we have:

```
synchronized(_me)
{
   _rtiAmbassador.associateRegionsForUpdates(_handle,
_newDistributionRegions);
   [ some calls that prepare an AttributeHandleValueMap object (_ahvm)
]
   _rtiAmbassador.updateAttributeValues(_handle, _ahvm, null);
}
```

In the `FederateAmbassador.provideAttributeValueUpdate` handler, we have:

```
[ validation code that checks the arguments passed in ]
synchronized(_me)
{
   [ some calls that prepare an AttributeHandleValueMap object (_ahvm)
]
   new Thread() { public void run() {
      _rtiAmbassador.updateAttributeValues(_handle, _ahvm, null);
   } }.start();
}
```

The key factor is that both snippets of code synchronize on the same object (`_me`).

Now a race condition occurs. Sometimes, the main thread enters and leaves the synchronized block before the Federate Service thread reaches its synchronized block. All is well, execution flows smoothly.

However, at other times the main thread is still within the synchronized block when the Federate Service thread starts up (because the `associateRegionsForUpdate` call has caused the object instance represented by `_handle` to come into scope for some other federate, and the RTI then fetches the attribute updates in preparation for distribution—remember that AutoProvide is turned on). The Federate Service thread will appropriately stop just before the synchronized block, because that monitor is owned by the main thread. What is buggy, however, is that the main thread's `updateAttributeValues` call then blocks for no discernible reason. The entire execution freezes as a result. By rights, the main thread's `updateAttributeValues` call, even though it'll put calls in the Federate Service thread's queue for later processing, should return normally so the main thread can then exit the synchronized block.

Put succinctly, if the Federate Service thread is in any kind of synchronization-waiting state (a semaphore, say), then a federate-triggering `RTIambassador` call by any thread will freeze, even if the latter `RTIambassador`-caller does not own any monitors.

It's as if the `RTIambassador` call, in the local RTI component, needed to wait after the `FederateAmbassador`, running in the Federate Service thread, to acknowledge the events being added to its queue, or something like that. Without knowing how the RTI is implemented, this surmise may be completely wrong; what matters is that the bug is real and potentially disastrous in its consequences.

Interestingly, even the pRTI Explorer seems confused about the state of the federation, as it reports the frozen federate as having no discovered instances of anything (even though there are some). This may conceivably be just a side-effect of the federate's frozen state on the Explorer's display methods.

Visual OMT 1516

Although there were a number of commercial offerings when the time came to edit OMT files for HLA 1.3, there is a dearth on the IEEE 1516 side. Several of the companies that existed at this project's outset have apparently gone out of business, or have failed to make the 1516 move.

Pitch offers its own tool, Visual OMT 1516, which has the excellent feature of being able not only to import 1.3 OMT files, but also to export 1516 object models to the 1.3 format. Automatic conversion is supported to a reasonable extent; since DDM is very different in 1.3 compared to 1516, human intervention is unavoidably required.

Visual OMT 1516 supported our federation object model design process without any serious trouble. Because there were really no other tools to compare it with, and because we made only light use of object model editing, no recommendations are made on this subject.

Bugs

The Visual OMT 1516 (version 1.04) interface suffers from one apparent bug, which may be in part a matter of design. When one wants to attach a note (a table of which is part of the OMT) to some item in the object model, one pops the contextual menu and navigates to the Notes sub-menu. It displays the Notes table, which can be edited in-place (a very nice feature). The Enter key shifts the focus to the next note in the list, the delete key deletes the current note, and so on.

To (un)associate one (or several) note(s) to the item, one (un)checks the tick box(es) appearing beside the chosen note(s). This can be done with the mouse or the space bar. But the changes "take" only if one exits the menu in a very specific, counter-intuitive way: *by (right or left) clicking one of the application menu titles*. This is very puzzling behaviour. It would have been much simpler to have the ticks "take" without the need for any further action. The Visual OMT 1516 User's Guide is unhelpful on this subject, as it declines to detail how notes are (un)associated to object model items. It laconically states "To add a note, right-click in the table-cell or on the label and select Notes on the menu."

3. JACK™ Intelligent Agents

JACK™ Intelligent Agents is an agent-oriented development environment built on the JACK Agent Language (JAL), which is an extension of the Java programming language. It is the property of Agent Oriented Software (AOS) Group, based in Australia, the United Kingdom and the United States.

In the same way that object-oriented programming introduces a number of key concepts that influence the entire logical and physical structure of the resulting software system, so too does agent-oriented programming. In agent-oriented programming, a system is modelled in terms of agents. These agents are autonomous, reasoning entities capable of making pro-active decisions while reacting to events in a real-time environment.

Agent-oriented programming ([33] Shoham 1993, [34] Wooldridge and Jennings 1995) is an advanced software modelling paradigm that arose from research in distributed artificial intelligence. It addresses the need for software systems to exhibit rational, human-like behaviour in their respective problem domains. This makes it ideally suited to the task of lightening the operator load required for a constructive simulation. Agents of varying degrees of sophistication could be responsible for simulating various expected entity behaviours, ranging from a civilian bystander's reaction to a sudden burst of gun fire, to the cunning expected of an adversary general. A similar pursuit of verisimilitude has been observed in the software gaming industry, where the quality of the behaviour of simulated entities can make or break the commercial success of the title. Adventure role-playing titles strive to have complex non-player characters that can actually keep parts of the plot in motion independently of the player's choice of actions, or serve as reasonably believable adventuring associates (hirelings, comrades, allies). Empire-building simulations strive to provide believable (and tuneable) adversaries that can give the player a good run for his money without resorting to obvious cheats such as drastically reduced time and money costs. The list goes on.

The term *agent* is widely used to describe a range of software components ([35] Franklin and Graesser 1996), varying in capability from procedural wizards (found in popular desktop applications), to information agents (used to automate information search and retrieval), and to intelligent agents capable of reasoning in a well-defined way. The agents used in JACK are *intelligent agents*. They model reasoning behaviour according to the theoretical Belief Desire Intention (BDI) model of artificial intelligence ([36] Bratman 1999).

Following the BDI model, JACK intelligent agents are autonomous software components that have explicit *goals* to achieve or events to handle (*desires*). To describe how they should go about achieving these goals, these agents are programmed with a set of *plans*. Each plan describes how to achieve a goal under varying circumstances. Set to work, the agent pursues its given goals (desires), adopting the appropriate plans (intentions) according to its current set of data (beliefs) about the state of the world. This combination of desires and beliefs initiating context-sensitive intended behaviour is part of what characterises a BDI agent.

An agent can be thought of as a person with access to a procedures manual. The procedures manual (set of plans) describes the steps that the agent should take when a certain event arises or when it wants to achieve a certain outcome. At first glance, this may seem like ordinary expert system behaviour—with all the limitations that this implies. However, the crucial difference in agent-oriented systems is that the agent exhibits goal-directed focus: it focuses on the objective and not the method chosen to achieve it. In addition, the agent is continuously aware of context, re-evaluating the validity or relative importance of various goals being pursued simultaneously in the light of new events or goals.

Overview of JACK

Events

Quite naturally, agent-oriented programming is an extension of event-driven programming. When an event occurs, it is either *posted* to the agent owning the entity wherein it arises, or *sent* to a specific different agent. The agent handling the event may react by taking action. There are a number of event types in JACK, each with different uses. These different event types help model:

External stimuli, such as messages from other agents, percepts that an agent receives from its environment, or belief state changes. These events make the agent reactive.

Internal stimuli, events that an agent sends to itself. These can represent sub-tasks that the agent uses to break down complex goals or meta-reasoning events that the agent uses to decide which plans to implement. They are integral to the ongoing execution of an agent and the reasoning that it undertakes, and make the agent proactive.

Motivations that the agent may have, such as goals that the agent is committed to achieving.

Events are the origin of all activity within an agent-oriented system. In the absence of events, an agent sits idle. Whenever an event occurs, an agent initiates a task to handle it. This task can be thought of as a thread of activity within the agent. The task causes the agent to choose between the plans it has available, executing a selected plan or plan set (depending on the event processing model chosen) until it succeeds or fails. Multiple tasks can be active at once, the agent using a specified task management policy to allocate its execution resources between them.

Belief Sets

In addition to ordinary Java data members and other data structures, the JACK Agent Language provides *belief set* classes that facilitate the maintenance of an agent's beliefs about the world, represented in a first order, *tuple*-based relational model. Each belief set relation consists of a set of *fields*, each of which can be any Java primitive type (`boolean, byte, char, short, int, long, float` and `double`), a `String` or an `Object`. All, none or some of the fields may be declared to be *keys*. Keys serve to indicate the object of a tuple; that is to say, what the belief is about. There will be at most one tuple in the belief set for any given combination of distinct keys (if none of the fields are keys, then all of the belief set's tuples are about the same unique object).

The belief sets automatically maintain their logical consistency: when an agent adds a belief that contradicts a previously held belief, the belief set detects this and automatically removes the old belief. They are also able to post events automatically when certain changes occur. Finally, cursor statements are supported (more on these shortly).

Belief Sets descend from two root classes, supporting Open World and Closed World semantics respectively. In a Closed World belief set relation, all statements (possible tuples) are either true or false, so that the unknown state cannot occur. In an Open World belief set relation, by contrast, all possible statements (beliefs) are initially in the unknown state and the agent can therefore establish a fact either by assertion (by affirming it) or by elimination (by denying all other possibilities). Another way of looking at it is that, in a Closed World, all possible queries have a definite yes or no answer, whereas in an Open World some if not most queries will probably be unanswerable.

Closed World relations theoretically represent every possible tuple; in practice, only those tuples that the agent believes to be true are stored, and any tuple that is not stored is assumed to be false. Open World relations store all true and false tuples, and assume any tuple that is not stored to be unknown.

The JACK Agent Language makes extensive use of *logical variables*, which, although typed, are initially unbound (have no definite value). They can be thought of as the unknowns in the initial statement of a problem. The problem is solved once all unknowns have been bound to specific values, a process known as *unification*. Unification can be invoked explicitly, or it can occur indirectly. Belief sets are normally queried through *cursors*, which are a means of scanning through the successive possible bindings of a set of logical variables. A cursor, when first queried, provides bindings for its implicated logical variables. If these bindings are determined to be unsuitable to the agent's purposes, the cursor, when next queried, rolls the bindings back and provides a new set of bindings (assuming one exists). In this fashion, an agent can entertain successive hypotheses until a satisfactory one is achieved.

Finally, for ease of interoperability the JACK Agent Language defines *views*, which can be thought of as highly abstracted belief sets. Much of the methods and behaviours automatically generated by JACK for a normal belief set become optional and can be implemented with great freedom of choice by the programmer. Views allow any external entity to be encapsulated to serve as a belief set. They can be used in a variety of ways, such as querying across multiple belief sets without duplicating the beliefs, or turning the keyboard input stream into a source of events, to name but two.

Plans

Plans are the heart of JACK agent programming. Plans describe sequences of actions that an agent can take when events occur. They can be thought of as the pages from a procedures manual; each describes, in explicit detail, exactly what an agent should do when a given event occurs.

Each plan is declared as handling a single event. When an instance of a given event arises, the agent first constructs the set of applicable plans. This set is initially constituted of those plans which the agent uses and which declare they handle this event. The agent further discriminates between these plans by checking their *relevance*. The `relevant()` method of each plan is a static (class-level) method which can examine the attributes of the event to decide whether it is relevant or not. A final criterion is *applicability*. The `context()` method of each plan is dynamic (instance-level) and serves to take into account the current circumstances (the agent's current beliefs and any other agent-accessible data). This is where, typically, the plan's logical members' values are bound. For every possible set of bindings, a separate applicable instance of the plan is generated.

Once the agent has found all applicable instances of each relevant plan, it selects one of these to execute. The selection method used is controlled through various programming means, which may include the posting of a `PlanChoice` event. JACK agents are fully capable of meta-level reasoning, that is to say, plans about plans.

The body of a plan is an instance of what the JACK Agent Language calls a *reasoning method*. Reasoning methods extend the normal Java execution paradigm, in that each statement is treated as a logical expression that can either succeed or fail. Another way to look at it is to consider the reasoning method's statements as being connected by Java conditional-AND operators (each reasoning method statement is atomic, however). A reasoning method fails as soon as it reaches a failed statement: this fails the plan instance, and the agent then fails the event handling or tries again with a different plan instance depending on how it has been programmed.

Besides the mandatory `body()` reasoning method, a plan may declare other reasoning methods as members. This is a convenience that facilitates the breakdown of complex plans for maintenance, re-usability and verification purposes. In particular, there are the `pass()` and `fail()` optional reasoning methods, which are automatically invoked by JACK once the plan succeeds or fails, respectively.

Another JACK Agent Language feature that appears within plans are the *reasoning method statements* or *@-statements*, language extension tokens which serve to wait or watch for certain conditions, to reply to events sent by other agents, or to post or send events under a variety of conditional modes (analogous to the usual control flow paradigms: if, switch, for, while, repeat until).

Capabilities

Capabilities are a programming convenience similar to Java packages. They are a means of structuring reasoning elements of agents into clusters that implement selected reasoning capabilities. This simplifies agent system design, allows code re-use, and encapsulation of agent functionality.

Capabilities are built in a similar fashion to simple agents: constructing them is merely a matter of declaring the JACK Agent Language elements required. Events, belief sets, views, plans, Java code and other capabilities can all be combined to make a capability.

It should be fairly obvious that a generic, re-usable HLA "module" for JACK is best implemented as a capability.

Multi-Threading

When we described events earlier, we mentioned that each event triggers a task, which corresponds to a thread of activity within the agent. Java is inherently multi-threaded, and switching between execution threads is normally the responsibility of the programmer. The Java execution engine does not guarantee safe points at which it will switch execution threads, so it is up to the Java programmer to implement object locking monitors and any other concurrency controls which may be required.

JACK is also multi-threaded but the context switching is managed in large part by the JACK kernel. Reasoning methods and task executions are Finite State Machines, meaning each statement is executed in a series of atomic steps, between which the agent can switch to other execution threads safely. A compound logical statement, for example, is executed in the usual short-circuit way, and thus each individual Boolean evaluation is a separate step. This simplifies considerably the task of making a plan thread-safe.

Each agent uses a *TaskManager* object to decide how to allocate its execution time between tasks (threads). The two most basic TaskManager strategies are depth-first (the agent pursues one task until it completes or blocks, then switches) and breadth-first (the agent executes a certain number of steps in any one task before switching to another, in round-robin fashion). More elaborate TaskManagers are possible, for example, prioritizing tasks.

JACK-HLA interface

HLA services, callbacks and JACK events

It was immediately realised that the HLA callbacks, which can occur at any time and are the only form of message issuing from the RTI besides the few services that actually return an immediate response value, should map to JACK events. The services, on the other hand, can be invoked from anywhere within the JACK code simply by providing the `RTIambassador` reference.

The HLA-expected behaviour of the Federate Ambassador is, in any case, minimalist: in order to allow callbacks to occur at any time and at as high a rate as necessary, the callback handler should conclude as quickly as possible. This is best achieved, as was discussed earlier, by storing the callback's arguments and either queuing the event internally (for processing by another thread) or spawning a separate worker thread. This is precisely what is achieved by posting a JACK event, so the match is natural.

However, the federate does have the opportunity (indeed, the responsibility) of throwing exceptions from within the callback's thread in order to advise the RTI that something is amiss. This behaviour is exceptional but may nevertheless be necessary. As a general rule, these exceptions are thrown if argument validation fails, each exception corresponding to a different validation failure mode. Because of the thread constraint, a generic HLA-JACK adaptor module must treat this validation activity as an exterior handler. We'll see later how this was achieved.

In order to post JACK events, our code needs access to an event posting method reference (an event factory) and to an agent reference (in order to invoke the postEvent or send methods). We first thought of putting the HLA FederateAmbassador implementing class in the project's Other Files section, but this does not work for the simple reason that an agent's event posting methods, once pre-compiled to Java, are private to the agent. There are two ways around this obstacle. The first is to add to the agent a series of public methods that each return a different event factory. It is crude but effective, and has the main drawback that the programmer must go through the drudgery of creating each event factory access method manually. In addition, it forces the agent to declare that it posts or sends the events (even though it does not) because the handles declaration only mentions the event type, omitting the event factory instance.

The second way is to move the HLA FederateAmbassador implementing class into the agent class as an inner class. This immediately gives it access to all of the enclosing agent's members.

Since the agent must manage several HLAchat instances in any case, putting their references in a belief set makes more sense. It becomes relatively easy to recover the HLAchat reference as part of each plan's context() method.

HLA1516 JACK Capability

An RTI implementation typically supplies a "null" Federate Ambassador implementation which the user is expected to subclass, overriding only those callbacks which are of interest to him. This null implementation simply implements each of the 56 callbacks but does nothing (the method bodies are empty). This makes the user's subclass code a lot more compact and easier to read. To follow this pattern, our HLA 1516 capability should post all possible events but not require the user to supply "null plans" for those events which are not of interest. We achieved this by having the capability handle each of the events as well as post them, but use in each case a null plan that categorically declares itself as irrelevant (the relevant() static method returns false in each case). This satisfies the JACK run-time initialization, which won't complain that the agent using the capability has unhandled events, and neatly avoids the undesirable side effect of having significant events "ambushed" by the capability. This would occur because JACK capabilities are searched for applicable plans before any of the agent's (or enclosing capability's) own plans.

Although the HLA Federate Ambassador interface consists of 56 different callbacks, there are only 43 differently named ones. Four callbacks (initiateFederateSave, reflectAttributeValues, receiveInteraction, and removeObjectInstance) are overloaded to varying degrees. These sets of overloaded callbacks can be safely combined into four events by substituting null arguments as needed, since the HLA specification guarantees that no argument will ever be null, except for the userSuppliedTag byte arrays which appear in eight callbacks (announceSynchronizationPoint, reflectAttributeValues, receiveInteraction, removeObjectInstance, provideAttributeValueUpdate, requestAttributeOwnershipAssumption, attributeOwnershipAcquisitionNotification, and requestAttributeOwnershipRelease). For example, initiateFederateSave has two forms, one with a single argument (a String), the other with two (a String and a LogicalTime); the former is rolled into the latter by passing a null LogicalTime.

Several sets of events have the same payloads (field sets) and could conceivably be further merged provided some discriminant fields were added. For example, the federationRestoreBegun, federationRestored and federationSaved events have no fields beside the identifier. There are no clear benefits to be gained from such mergers, however, except possibly for those events which pair off in Boolean fashion: attributes In/OutOf Scope, turnUpdates Off/On ForObjectInstance, objectInstanceNameReservation Failed/Succeeded, requestFederationRestore Failed/Succeeded, start/stop RegistrationForObjectClass, and turnInteractions Off/On. This is really a matter of programming style more than anything else.

To allow an agent using the capability to potentially manage multiple federates, the capability's inner class (HLAfederate) has a single constructor that expects an identifier String argument. This argument is prefixed into each event posted out of the capability, thus allowing the agent to tell which of the Federate Ambassadors generated it.

Next, to allow the HLAfederate's callbacks to throw exceptions as needed, we declared 43 interfaces (one for each differently named callback) which consist of a single method (validate) accepting the callback's arguments and throwing its exceptions (the method is overloaded just like the callback itself). The HLAfederate stores privately a reference to each of these interfaces, null by default, and exposes get and set methods to allow the references to be manipulated. When a callback is invoked by the RTI, if the corresponding validation interface reference is non-null, the arguments are passed to it before moving on to the event posting method.

Thus, the capHLA1516 capability consists of:

- An inner class (HLAfederate), which includes a placeholder member for the federate's RTIambassador instance;

- Forty-three events (MessageEvent) encapsulating the 56 HLA 1516 Federate Ambassador callbacks, each both posted (#posts external event) and handled (#handles external event) externally; and

- Forty-three used plans (#uses plan), each of which declares itself as irrelevant (the static relevant method returns false) and has consequently no reasoning method; and

- A belief set prototype (blfHLA), an instance of which you must supply to the capability.

The blfHLA belief set is used by the capability to manage the HLAfederate instances. The enclosing agent (or capability) queries the belief set in order to recover the HLAfederate instance, using the identifier prefixed to the event. This is typically done by its plan's context() method.

Figure 19 illustrates the process. The RTI's callbacks are handled by the HLAfederate instance, which tacks its identifier to the event parameters set when invoking the capability's event factory. The agent may supply validator methods to the HLAfederate instance if it wishes exceptions thrown at the RTI. The HLAfederate instance has a placeholder for the corresponding RTIambassador instance, so the agent's plans may easily invoke RTI services.

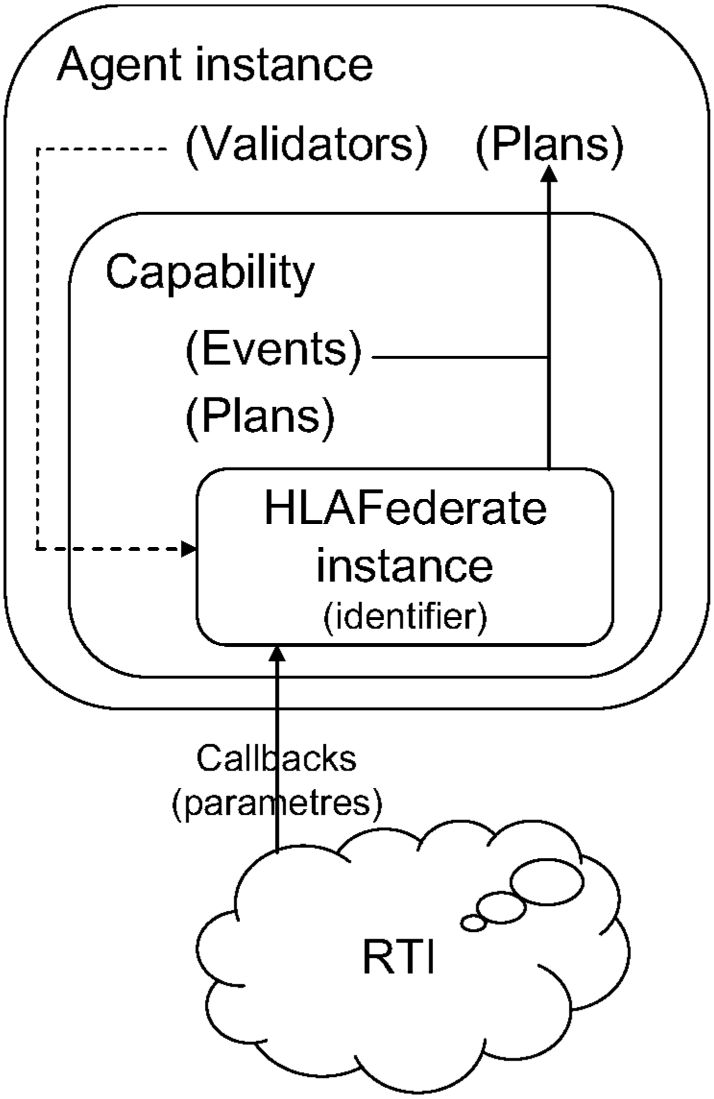

Figure 19. *How an agent uses the HLA capability*
The agent is free to specify Validator interfaces or not; it is also free to ignore irrelevant events.

External dependencies were kept to a minimum. The capability imports the generic `hla.rti1516` classes, and two of our own packages. The first, `ca.gc.drdc_rddc.hla.rti1516.omt`, implements the `HLAopaqueData` datatype (as specified by IEEE 1516.2 at 4.12.6) which is used to wrap the `byte[]` arguments occurring with certain callbacks. This was necessary to circumvent JACK's inability (in its 4.1wj version) to cope with `byte[]` event fields. Another possible solution would have been a `java.nio.ByteBuffer` implementation (the Java 2 Platform class is abstract), but since an HLA-capable JACK agent is likely to use other HLA OMT classes, it seemed more logical to supply those anyway.

The second, `ca.gc.drdc_rddc.hla.rti1516.FedAmb`, specifies the event validation interfaces.

In a concrete application, an RTIambassador implementation is required. This is part of what each RTI vendor supplies, and its constructor can take a variety of guises. Luckily, we don't need to worry about this. The HLAfederate class supplies a placeholder RTIambassador member (rtiAmbassador), which is expected to be filled in by the agent using whichever means it finds convenient.

Finally, we expect the using agent to extend the HLAfederate class as a convenient way of keeping all federate-related fields and methods together. In order for the belief set's getInstance query to return the correct Object instance, the only requirement on the extending class is that its constructor invoke the superclass's constructor through the super keyword, something which Java enforces anyway.

HLA13 JACK Capability

Retrofitting the HLA1516 capability for use within an HLA 1.3 context turned out to be very easy. The HLA1516 capability was used as a template, the processing model remaining the same. The classes and interfaces were repackaged to avoid conflicts with 1516, and the methods and interfaces appropriately renamed.

JACK Integrated Development Environment (IDE)

The JACK Development Environment (JDE) is decent but suffers from a number of really annoying deficiencies. The built-in text editor recognises only a small set of key strokes and is seriously deficient when compared with such simple editors as the Windows built-in Notepad. Understandably, AOS does not want to spend much effort on it and prefers investing in the useful aspects of the engine. JACK does offer the capability to use an "external" text editor, which is something we never got around to trying out. It may solve the problem nicely. The JDE also seems to suffer from some form of memory leakage: after opening, editing, closing and saving various parts a fair number of times, we get a message that the JDE is running out of memory. At that point, one saves the project and restarts the JDE: a mere annoyance.

It may be that version 5, delivered as this report was nearing completion, solves some of these small complaints.

The JDE is not as robust as it should be, and even an unimaginatively devious user can create all sorts of problems for himself. A few examples:

- If you drag and drop a Named Data to an Agent's Belief Data container twice, you get two identically-named references, which of course won't compile properly.

- If you create several Named Data instances of various types, they all get the same default name "data", which leads to confusion and/or compilation errors later on. A simple default name convention could be "data_<BeliefSet Type>_1" (e.g. "BeliefSetDelusions" would generate "data_BeliefSetDelusions_1").

- If you Remove an Event Type from the project window, any separate windows previously created for that Event remain opened instead of closing (and will still accept drag-and-drop, editing as JACK file, etc). One can even create a new Event Type using the still-open Event's name, leading to potentially catastrophic confusion within the project's file structure. The same can occur with Events' Fields, Agents, Plans, Capabilities, Events' Posting Methods, BeliefSet Queries, etc.

- Using drag-and-drop, it is quite possible to mark a Capability as having itself as a Sub-Capability. Is this reasonable or will it create an infinite loop of some sort? If the latter, care will need to be taken to make sure the Capability hierarchy remains an acyclic directed graph (thus if B is a sub-capability of A, then it should not be possible to declare A as a sub-capability of B, and so on regardless of the number of intermediate steps).

If one treats the JDE as the fragile thing it is, all is well. Productivity may not be what it should be (compared to Java Integrated Development Environments (IDEs) such as NetBeans or Eclipse), but it is tolerable.

JACK Bugs

Defining an array field for a `MessageEvent` or `BDIMessageEvent` (but not for the other event classes) causes a compilation problem. This occurs both with primitive data types (`byte`, `int`, etc.) and with classes in general, although the error reported is different. This is apparently (according to AOS) a limitation of using the JACOB transportation of message events by default. The solution is either to force the use of Java serialization as the event transport mechanism (by adding `#set transport java;` to the event class definition), or to wrap the array in a utility class (`HLAopaqueData` in our case).

JACK Pre-Processor Bugs

The JACK-HLA interfacing effort revealed a number of unexpected JACK bugs, which arose from its pre-processor. When a JACK application is compiled, the pre-processor reads the plans, events, agents and other JACK-specific constructs in order to process the JACK Agent Language syntax extensions. The remaining code is expected to be standard Java but is nevertheless validated as part of the pre-processor's parsing. This step is required because JACK must parcel out the Java statements into the sometimes rather involved Java structures that make the extensions understandable to the Java virtual machine. For example, each of the statements in a plan's reasoning method has to be put in a separate branch of a large switch statement at the heart of a finite-state-machine loop understandable by the proprietary JACK executable classes.

It turns out that some unusual Java syntax is involved in invoking or extending inner classes, and that the JACK pre-processor did not understand those correctly. This resulted in spurious errors being reported during the pre-processing phase.

Specifically, this line would not compile:

```
String s = AgentClass.InnerClass.aConstantString;
```

Here we use a qualified class identifier to access an inner class's static member. A simple workaround is to have the outer class pass the inner class's member out through a static member of its own. This line wouldn't compile either:

```
AgentClass.InnerClass inner = agent.new InnerClass();
```

Here we invoke an inner class's constructor by qualifying it with the enclosing instance, as is proper. A simple workaround is to have the outer class pass the inner class's constructors out through a factory method of its own.

A third instance of the problem arises when one extends an inner class from outside itself. In such a case, the Java language dictates that the extending class's constructor use the ancestor's enclosing instance as its first argument. By itself, that works fine, but if you need to invoke the ancestor's constructor through the `super` keyword, the latter will also need to be qualified by the ancestor's enclosing instance, like so:

```
public class
OuterClass
{
…
   public class
   InnerClass
   {
      …
   }

   public class
   InnerClass_Descendant
     extends InnerClass
   {
      public
      InnerClass_Descendant(OuterClass containingInstance)
      {
         containingInstance.super();
         …
      }
   }
}
```

In this case the qualified `super` stalls JACK's pre-processor. There is no simple workaround in this case, except to comment the offending line out, compile the project, then manually uncomment the `super` call from the generated agent's `.java` file and recompile it. This is awkward, but it gets the job done.

Although we have not tested this, AOS assures us these bugs are all fixed in the newest release of JACK.

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4. Chat Application

We chose as our test case a chat application. The main virtue of such a simple demonstration is that it pre-existed in both the HLA and JACK cases, a natural consequence in both cases of their network-awareness.

One of the very first network chat applications was ARPANet's Planet chat system, in 1973. Internet Relay Chat (IRC) itself was invented by Jarkko Oikarinen in 1988 at the University of Oulu, Finland ([37] Hardy 1996, [38] Kantor 2003). It became popular after it was made famous during the Iraqi invasion of Kuwait in 1991, where it was used by people to get information about events in Kuwait to the outside world after all other forms of communication had been cut off.

A chat application can be a simple text-only interface, command-line-driven, which allows a user to (this list is by no means exhaustive, but it is sorted in rough order of feature necessity):

- Log into and out of the network;
- Send and receive text messages;
- Join or create chat groups (chat rooms);
- Send and receive private messages (messages addressed to a single other user);
- Find out which groups/rooms exist; and
- Find out which other users are logged on.

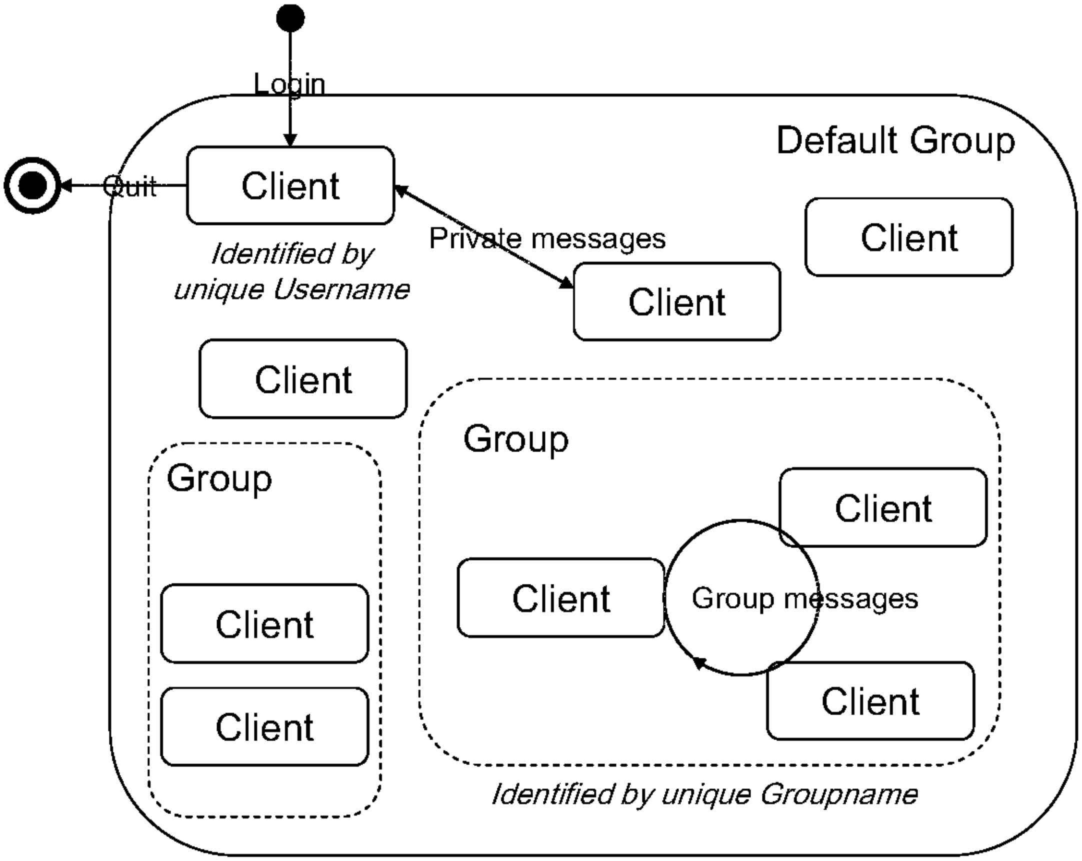


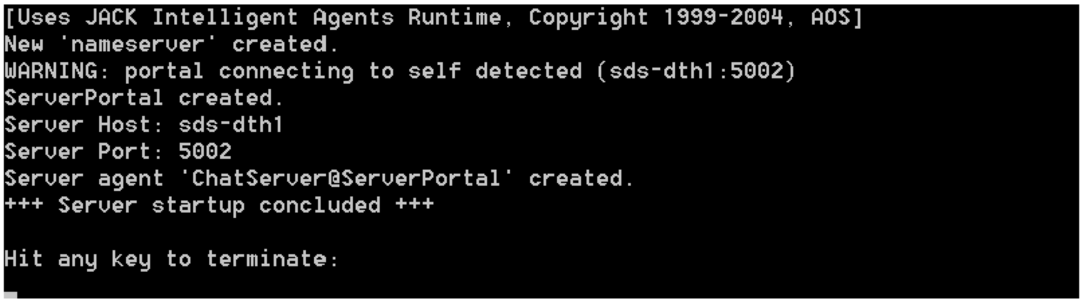
Figure 20. *A high-level view of a chat application*

Figure 20 illustrates the functioning of a chat application. Each client instance logs in and out of the chat network, appearing in the Default Group (a variety of names are possible: the "Reception Hall", the "Lobby", the "Town Square", etc.). Groups (chat rooms, channels, etc.) are created at will, and destroyed once empty. Clients can join a group or leave it (revert to the default group). Messages are sent to all clients within a group unless private messaging is used. Groups can be organized hierarchically, sub-groups being considered "in" their enclosing group, but this is not considered here.

JACK Chat Demonstration

We chose as our starting point the JACK chat demonstration. We strove to change as little of the application as possible, which meant the Client agent could not be changed. Because the JACK chat demonstration uses a Client-Server paradigm, this was easily achieved.

The JACK chat demonstration consists of two executables, a Server and a Client. Each instance of the Server agent manages a separate chat network, and each Client instance must specify (in its command line) to which Server it will connect. The Server is completely automated; the only user interventions consist of starting it and shutting it down.



```
[Uses JACK Intelligent Agents Runtime, Copyright 1999-2004, AOS]
New 'nameserver' created.
WARNING: portal connecting to self detected (sds-dth1:5002)
ServerPortal created.
Server Host: sds-dth1
Server Port: 5002
Server agent 'ChatServer@ServerPortal' created.
+++ Server startup concluded +++

Hit any key to terminate:
```

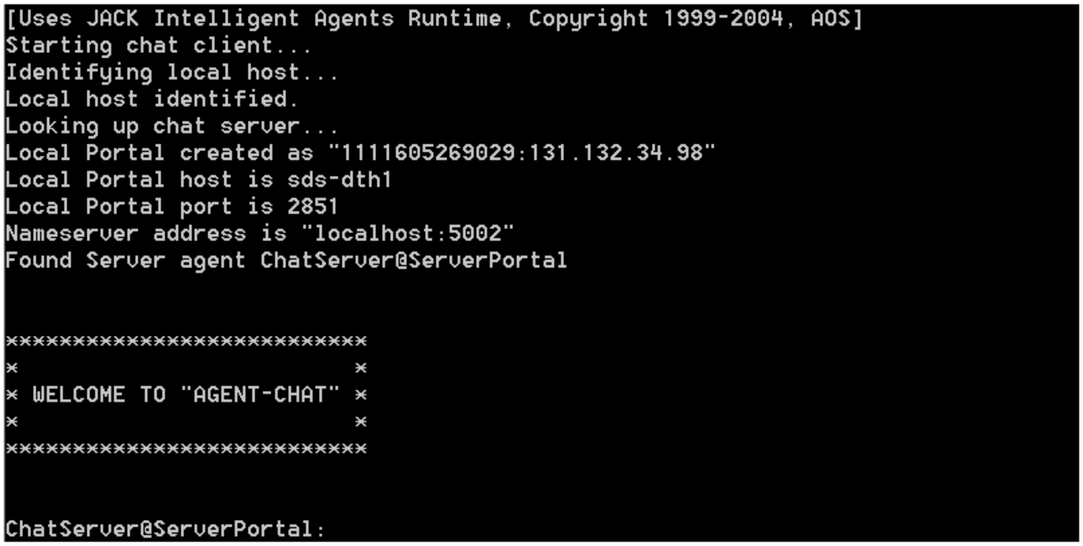
Figure 21. *The JACK Chat Server window*
Its role is analogous to the RTI's RTI Manager application.

The Client uses a command line interface with a two-state architecture. Initially, the Client is in the “Logged-Out” state. The user has a very limited choice of commands:

- The commands `quit` or `exit` will shut down the Client agent altogether;

- The command `login <username>` will attempt to log the Client onto the chat network;

- Any other command acts as a `help` command and lists the possible commands.



```
[Uses JACK Intelligent Agents Runtime, Copyright 1999-2004, AOS]
Starting chat client...
Identifying local host...
Local host identified.
Looking up chat server...
Local Portal created as "1111605269029:131.132.34.98"
Local Portal host is sds-dth1
Local Portal port is 2851
Nameserver address is "localhost:5002"
Found Server agent ChatServer@ServerPortal


***************************
*                         *
* WELCOME TO "AGENT-CHAT" *
*                         *
***************************


ChatServer@ServerPortal:
```

Figure 22. *The JACK Chat Client window at start-up*

If the login fails, the Client remains in the "Logged-Out" state. Otherwise, the login request was successfully processed by the Server (that is to say, the requested username was available) and the Client is now in its "Logged-In" state, and joins the "General" chat group. New commands become available:

- The `logout` command disconnects the Client from the chat network and shuts down the Client application;

- The `join <groupname>` command joins the Client to the specified chat group, creating the group if necessary;

- The `leave <groupname>` command unjoins the Client from the specified chat group;

- The `who [<groupname>]` command lists the users (including the Client) currently in the specified chat group (if unspecified, the Client's current chat group joined is assumed);

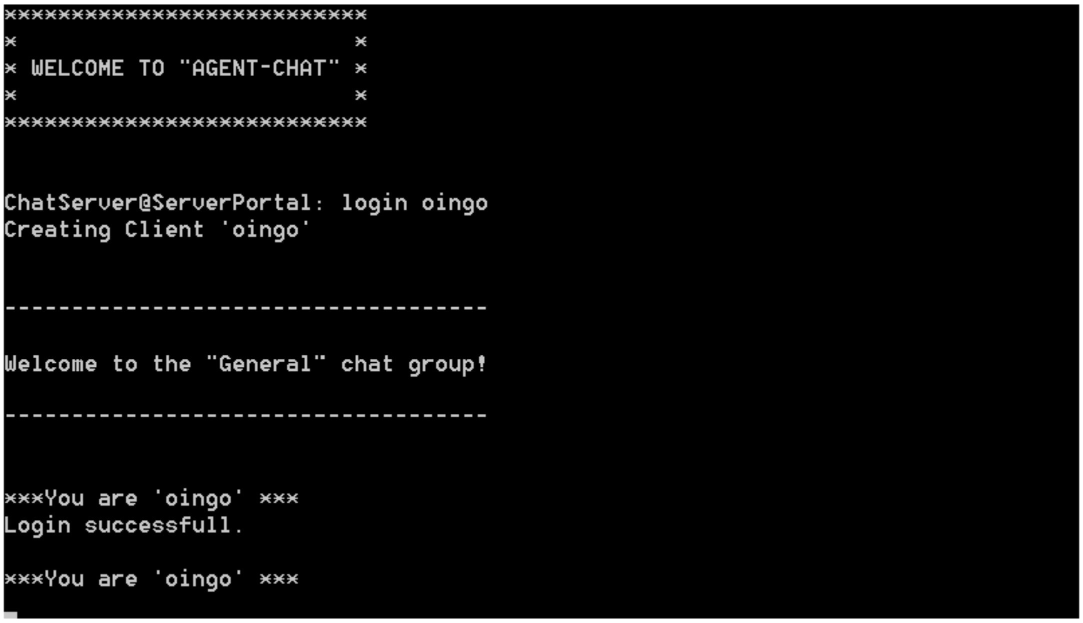
- The `msg <text>` command sends the message (the specified text) to the users in the Client's current chat group;

- The `msgusr <username> <text>` command sends the message (the specified text) to the specified user;

- The `group` command lists the existing chat groups; and

- The `help` command lists the available commands.

Advisories appear when another user either joins or leaves the group the Client is in.



```
***************************
*                         *
* WELCOME TO "AGENT-CHAT" *
*                         *
***************************


ChatServer@ServerPortal: login oingo
Creating Client 'oingo'


------------------------------------

Welcome to the "General" chat group!

------------------------------------


***You are 'oingo' ***
Login successfull.

***You are 'oingo' ***
```

***Figure 23.** The JACK Chat Client window after logging in*

The application, as supplied, suffers from two design flaws: 1) nothing prevents a Client from joining multiple groups; and 2) nothing prevents a Client from leaving all groups, even the default one. This was clearly unintended since each Client remembers only the last group it joined and can only send to its "current" group (the last one joined). Joining multiple groups means a client will receive messages from *all* of the groups it has joined. A Client that joins more than one group and then leaves the last one no longer knows which group(s) it is in. It considers itself group-less and thus unable to send any group messages. Finally, a group-less Client can only be reached by private messages.

Clearly the intent was to restrict the Clients to belonging to one and only one group at all times, and to have them revert to the default group when leaving a specified group. It is possible to properly support multiple-group affiliation (by sending messages to all groups one belongs to, and warning the user when he ends up group-less), but that adds complexity which is not useful for our purpose: an HLA-JACK interoperability demonstration.

Figure 24 shows the key features of the JACK Chat demonstrator. Each Client instance must go through the same Server, identifying itself through a login request. All Client requests go through the Server. The latter maintains three belief sets: a mapping of usernames to Client instance references, a list of extant groups, and a mapping of Client usernames to group names (which keeps track of the group each Client is "in"). Using these belief sets, the Server can easily supply lists of groups and lists of co-located Clients, as well as manage the flow of messages between Clients.

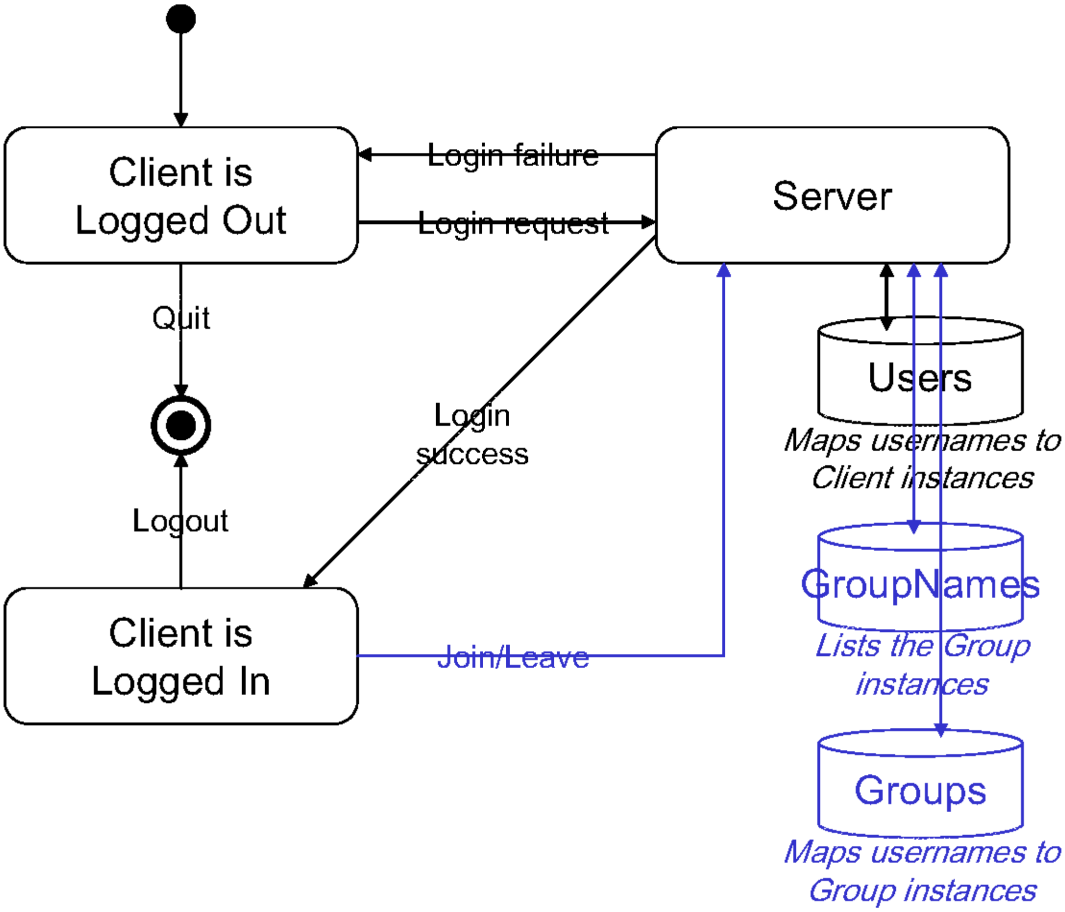


Figure 24. The JACK Chat demonstration
In blue, the group management subset.

In retrospect, the arbitrary decision to maintain the Client-Server architecture used by the original JACK demonstration may not have been the best approach. By keeping the Client unchanged, we are incurring a double networking overhead. Every time HLA invokes a callback in a JACK FederateAmbassador instance, this occurs within the Server's process space. The Server then posts an event to itself and goes through the overhead of binding to the FederateAmbassador instance from within (one of) its task processing thread(s). The plan then eventually sends a message to the appropriate Client, going through JACK's own communication layer. The process occurs in reverse when a Client sends a command out. Note that if the Server is using a single task thread (the default setting), it will handle only one client's callback at a time.

We could have had each JACK Chat instance be its own server. This would do away with the JACK communication layer, get rid of the FederateAmbassador instance binding overhead (or at least reduce it to a minimum), and allow true multi-tasking (since each client would operate in its own process space).

HLA Chat Demonstration

Although a number of HLA chat demonstrations exist, we chose to develop one from scratch in order to match the operational concept of the JACK chat demonstration as closely as possible.

HLA is a very "democratic" architecture: all federates are equal in importance in the eyes of the RTI. Breaking this symmetry is possible but is a function of the federation's semantics: during federation development, a federate may be singled out to act as a "server" for certain classes of objects, for example. For our Chat demonstration, we decided to use a peer-to-peer architecture, where all federates are "clients." This means the JACK "Servers" must become proxies for their Clients, managing multiple `FederateAmbassador` instances on their behalf but having no existence as far as the federation is concerned.

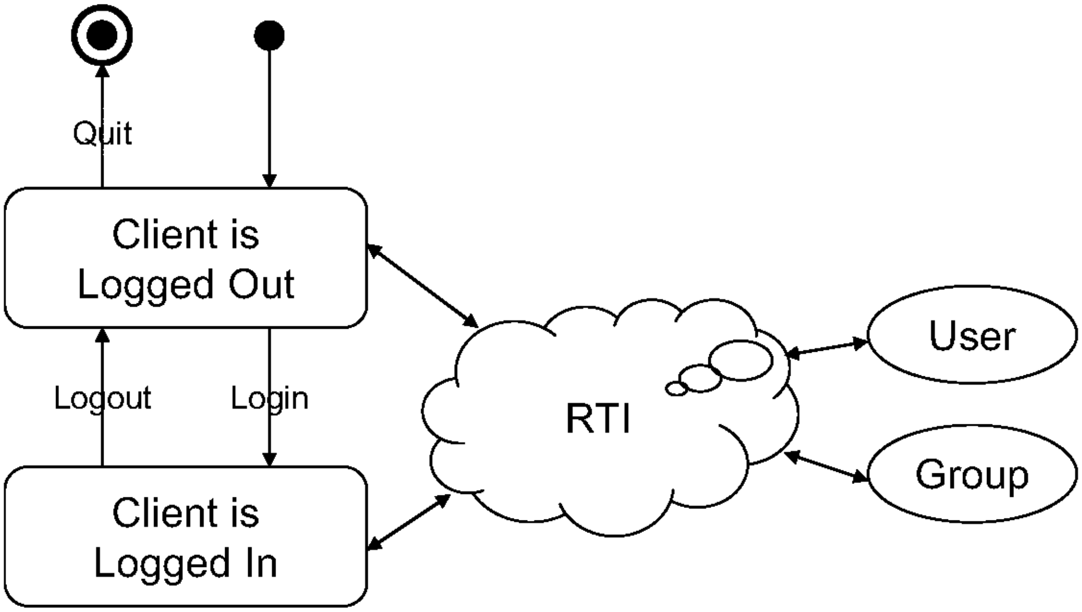
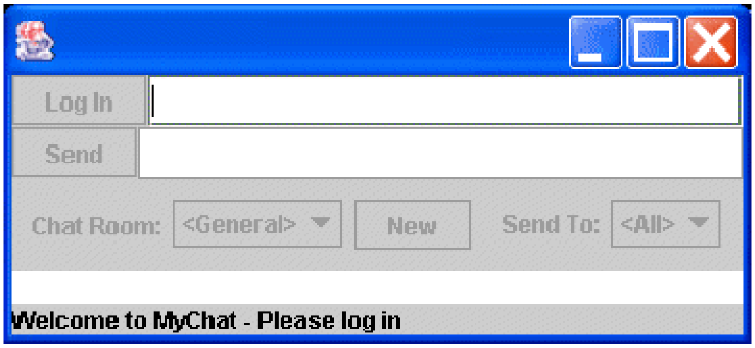


Figure 25. *The Java Chat demonstration*
Besides events, the client is aware of User (Participant) and Group (ChatRoom) objects.

Our pure-Java Chat Client uses a graphical interface. Initially, the Client is in the "Logged-Out" state. The user can then either:

- Shut down the Client altogether; or
- Attempt to log in after specifying a `<username>`.



Welcome to MyChat - Please log in

Figure 26. *The Java Chat Client window after start-up*

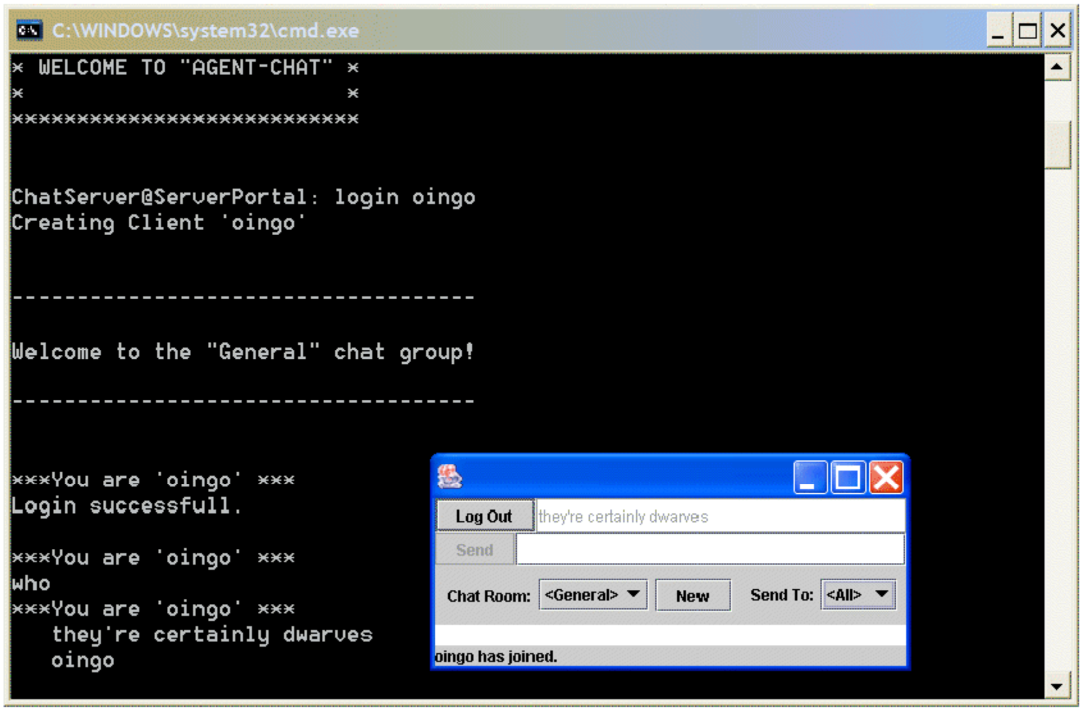
Once successfully logged in, the Client joins the "General" chat group. The extant chat rooms are listed, as well as the other users that are in the same chat room. The user can now:

- Shut down the Client altogether;
- Log out from the chat network and return to the "logged out" state;
- Join a group (chat room) by selecting it from the drop-down list;
- Create a group (chat room), specifying its name (the "New" button);
- Send a message to the users in the Client's current chat group; or
- Send a private message to one of the other users in the Client's current group (message addressees are designated using the "Send To" drop-down list).

Advisories appear when another user either joins or leaves the group the Client is in.

As can be seen, the semantics are essentially the same. Key differences are that the Client is now always in exactly one group at a time, and that private messages are only possible within the current group. These changes were integrated into the JACK chat at the same time that it was interfaced with the HLA chat. We confined the changes to the Server part of the JACK chat demonstration, which means the Client's interface is now less suitable. The "leave" command still requires that the group being left be specified, which is pointless now since the client can only leave the current group. Such is the price of backward compatibility.

Figure 25 adapts Figure 24 to the Java context. The server is eliminated and the RTI acts as a connector between the Client instances, mediating User and Group objects (as well as Message interactions). The semantics of the federation now reside in the expected behaviour of the federates (the Clients), and are thus much less readily apparent from this type of diagram.

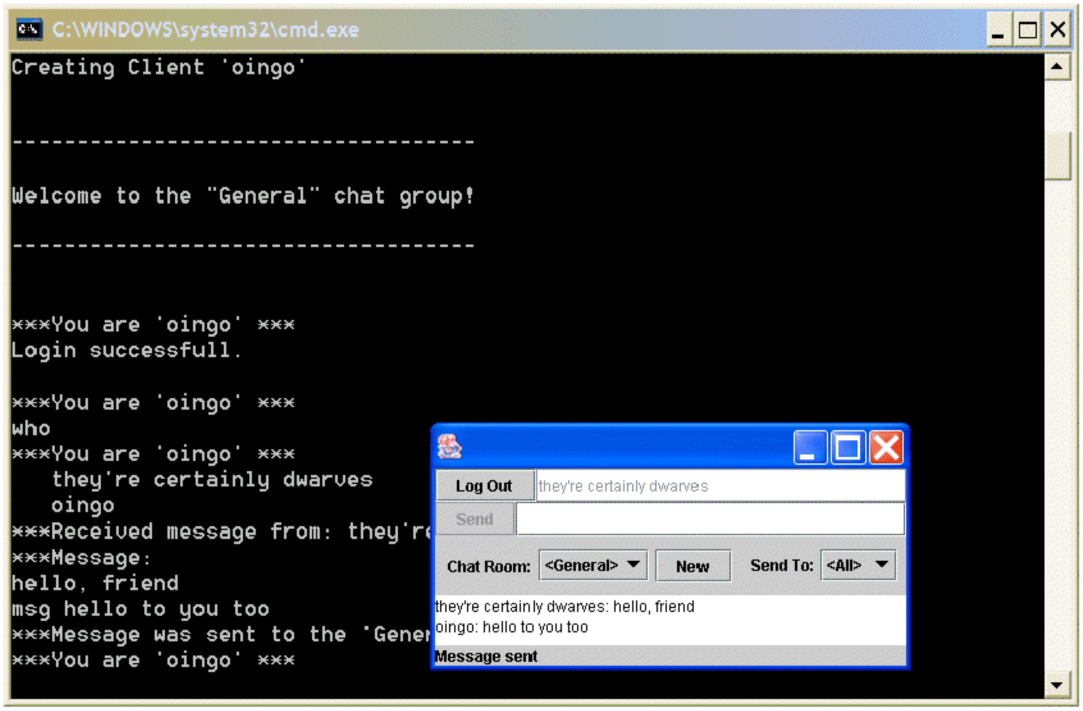


```
* WELCOME TO "AGENT-CHAT" *
*                         *
***************************


ChatServer@ServerPortal: login oingo
Creating Client 'oingo'


------------------------------------

Welcome to the "General" chat group!

------------------------------------


***You are 'oingo' ***
Login successfull.

***You are 'oingo' ***
who
***You are 'oingo' ***
   they're certainly dwarves
   oingo
```

they're certainly dwarves

oingo has joined.

Figure 27. The Java and JACK Chat Client windows after both have joined



```
Creating Client 'oingo'


------------------------------------

Welcome to the "General" chat group!

------------------------------------


***You are 'oingo' ***
Login successfull.

***You are 'oingo' ***
who
***You are 'oingo' ***
   they're certainly dwarves
   oingo
***Received message from: they'r
***Message:
hello, friend
msg hello to you too
***Message was sent to the 'Gener
***You are 'oingo' ***
```

they're certainly dwarves

they're certainly dwarves: hello, friend
oingo: hello to you too

Message sent

Figure 28. The Chat federation in action

HLA Chat Federation Object Model

Dimensions

Because we need to use DDM in two different ways (to channel messages by group and by user), we shall define two dimensions:

- `ChatRoomSlots` ([0..32 768[, excluded by default)

- `UserHandleSlots` ([0..2 147 483 647[, excluded by default)

Here we ran into a bug with Pitch pRTI 1516. The 1516.2 specification states that dimensions can be of any simple or enumerated datatype, although their upper bound is always specified as an integer. Since the integer basic datatypes (1516.2 4.12.3 Table 23) are 16-, 32- and 64-bit (two's complement signed) integers, it should be perfectly legitimate to define a dimension that uses the `HLAinteger64BE` datatype. However, pRTI 1516 RTIexec throws an `ErrorReadingFDD` "Invalid dimension upper bound" exception when `createFederationExecution` is invoked with an FDD containing dimension upper bounds reaching or exceeding 2^{31} = 2 147 483 648. Apparently pRTI 1516 tries to store internally the upper bound as a Java `int` (32-bit two's complement signed integer). Note also that the specification does not mention what should happen if you define a dimension with datatype `HLAinteger64BE` and then try to define a default range that covers the entire positive span: 64-bit signed integers can range up to 2^{63}-1, which means an upper bound of 2^{63}, a number which cannot be represented as an `HLAinteger64BE`. This occurs only because upper bounds are defined by their excluded value (dimensions are semi-open intervals, ranging from zero, inclusive, to the upper bound, exclusive).

Switches

The switches we enabled are:

- `AutoProvide`

- `AttributeScopeAdvisory`

- `InteractionClassRelevanceAdvisory`

The AutoProvide switch is simply convenient; it means our subscribing federates need not send a Request Attribute Value Update after discovering an object. The RTI will solicit the owner automatically with a Provide Attribute Value Update callback.

The Java Chat federate uses the Attribute Scope Advisories to add to/remove from its drop-down list of private message targets. The JACK Chat federate does not care about these advisories, since the Server resolves the list of potential chatters only when a Client requests it (using the `who` command). The Java federate could have used object discovery to accomplish the same thing (an attribute scope advisory always follows a discovery notification), but this approach involves considerably more overhead. Firstly, in order to receive a discovery notification every time an object comes into scope, the federate must "forget" about the discovered object (using the LocalDelete service) every time it goes out of scope. This required action cannot be accomplished within the scope advisory callback because of the `ConcurrentAccess` feature (q.v.): it must be threaded off. Secondly, this also entails the additional attribute value traffic concomitant with discovery.

The Interaction Class Relevance Advisories, finally, are used in an unexpected fashion to solve the federation destruction problem, as we'll see later on.

Datatypes

We defined only two additional datatypes beyond the mandatory basic datatypes:

- `ChatRoomRegistryEntry` is a fixed record of two fields:

  `name` is an `HLAunicodeString`

  `slot` is an `HLAinteger16BE`

- `ChatRoomRegistryEntries` is a dynamic array of `ChatRoomRegistryEntry`

Attributes of our custom datatypes which are sent to the RTI or received from it are passed as byte arrays, and the RTI does no validation whatsoever over them. It is entirely up to the federates to ensure that they use the same classes to encode and decode the custom datatype attributes. This can be seen as providing flexibility, but it is also fraught with potential disaster. Subtle differences in the implementations of a custom datatype between two distinct federates may lead to apparently correct behaviour until very specific circumstances arise where the byte representations diverge, unless cross-certification is exhaustive.

Interaction Classes

We defined a single interaction class:

- `Communication` has two attributes:

  `message` is an `HLAunicodeString`

  `sender` is an `HLAunicodeString`

This represents a chat message being sent across the network. The `message` is the "payload", that is to say, the text being sent by the user. The `sender` serves simply to identify the sending federate by its user name; this is necessary because users expect the interface to attribute messages as they occur, whereas HLA does not explicitly provide an interaction's provenance. In order to make DDM possible, the interaction is associated with both dimensions.

Object Classes

We defined three object classes:

- `ChatRoomRegistry` has one attribute:

  `list` is a `ChatRoomRegistryEntries`

- `ChatRoom` has two attributes:

  `slot` is an `HLAinteger16BE`

  `name` is an `HLAunicodeString`

- `Participant` has three attributes:

  `logged_in` is an `HLAboolean`

  `user_handle` is an `HLAinteger32BE`

  `chat_room_slot` is an `HLAinteger16BE`

The attributes of both the `ChatRoom` and the `Participant` are associated with the `ChatRoomSlots` dimension. The `ChatRoomRegistry` is treated as a "global" object and therefore does not have its attribute associated with a dimension.

General Principles of Operation

Although HLA considers ownership at the instance attribute level (that is, an object instance's attributes could each be owned by a different federate), in our simulation we will treat ownership at the object instance level. Ownership will be transferred using the same single attribute set for each instance of any given object class: the object's FOM-specified attributes plus the `HLAprivilegeToDeleteObject` attribute. This simplifies what is meant by "ownership" and suits our purposes nicely.

The first important design decision was to forgo time management entirely. None of the federates are time-regulating or time-constrained, and all HLA messages will be receive-ordered. This simplifies considerably some aspects of the federation, but it also means that any required synchronization will have to be accomplished by non-time-dependent means.

In order to allow the users complete freedom in specifying their user names and chat room names while avoiding collisions with the RTI-reserved names (anything beginning with "HLA", in any mixture of case), we chose to systematically prefix object names. These prefixes are for the federation's consumption, and are not seen by the users. Participant objects' names are prefixed by "p", ChatRoom names are prefixed with "c", and chat-system reserved names are prefixed with "_". This approach also prevents collisions between user-specified ChatRoom names and system-reserved ChatRoom names.

Role of the Participant Objects

The `Participant` object can be described as a "pass", required for admittance to the chat federation. When a user logs on, he does so under a specific user name, which must be unique. The user name is borne, appropriately prefixed, by at most one Participant object instance. If the federate manages to obtain ownership of that Participant object instance (through creation or ownership transfer), the log-on is successful. Accordingly, the federate shall refuse to relinquish ownership as long as it remains logged on.

To ensure the uniqueness of user names, it is much simpler to use HLA's Name Reservation service rather than implement some name control scheme of our own. However, HLA's Name Reservation service is *persistent*, in the sense that once a name has been reserved, it cannot be used again, even if the object instance is deleted. This means our Participant objects must also be persistent, being deleted only when the federation itself is destroyed. Hence the `logged_in` attribute, which serves to mark those Participant instances that are "in use."

Another feature of HLA is that objects must not become "orphans." That is to say, they must have at least one owner (i.e. at least one attribute must be owned) at all times, otherwise they become undiscoverable (see Ownership Management in Section 2 for details). Therefore, we will need to pass ownership (*custody*) of "logged out" Participant objects around as federates join and resign from the federation.

The `user_handle` attribute will serve not so much to identify the owner of the Participant object as to allow private messages to be sent. It designates a slot in the `UserHandleSlots` dimension and is very simply the 32-bit integer representation of the HLA object instance handle. In that sense, it is just as unique as the object instance's name, and is associated with that name for the duration of the federation.

Whether we map object instance handles or object instance names (Unicode strings) to a dimension (the HLA specification, at 1516.2 4.6.1, states that each federate must provide a normalization function that maps values from the federate view of a dimension to values in the RTI view of a dimension), we face precisely the same problem: they are dynamic arrays of bytes. It is tempting to use the `hashCode()` method to map these "keys" to a 32-bit integer dimension. However, the standard `java.lang.String.hashCode()` implementation is more likely to produce collisions (between Strings of four or less characters and Strings of five or more characters, for example) than the `hla.rti1516.ObjectInstanceHandle.hashCode()`. No collisions at all are expected for handles which are 32-bit or less wide, as long as the comparisons are between same-class objects. An eventual RTI using 64-bit wide handles could allow `hashCode` collisions to occur, but even then this seems extremely unlikely. For our purposes, `ObjectInstanceHandle.hashCode()` was deemed sufficient.

One notes that the Management Object Model (MOM) specifies the `HLAfederateHandle` datatype as being a 32-bit integer. However, as the specification states, "this is a pointer to an RTI-defined programming language object, *not* an integer 32." The datatype indeed represents a Java reference to a `FederateHandle` interface, and is used (within the MOM) only for the `Federate` dimension. In other words, the instance attributes `HLAmanager.HLAfederate.HLAfederateHandle` are `HLAhandle`s, and each of those contains a `FederateHandle` reference, passed to `RTIambassador.normalizeFederateHandle` as the MOM `HLAfederateHandle` datatype.

The `chat_room_slot` attribute, finally, indicates in which chat room the Participant "is."

Role of the ChatRoom Objects

The `ChatRoom` objects represent the chat groups which are dynamically formed and dissolved as the federation executes. A logged-in user's Participant token is "in" precisely one chat room at all times. Each ChatRoom occupies a slot in the `ChatRoomSlots` dimension, and this serves to channel communications using DDM. Ownership of ChatRoom objects is not as critical as with Participant objects, and it is expected that it will pass around. The federation ensures that ownership of a ChatRoom object (other than the Waiting Room) remains with one of the Participants in it. A ChatRoom that would become "empty" is deleted (except for the Waiting Room).

There are three special chat rooms. The "Nowhere" room is never instantiated; it is a reserved chat room slot that can be published into but to which no federate ever subscribes. It serves as a publication safety net, to prevent object attributes from reverting to the default region. The "Waiting Room" is instantiated only once, using the Name Reservation service, and is as a result never deleted, even if empty. It serves as a storage area for inactive ("logged out") Participant objects. The "General" chat room, finally, is the default room one joins when first logging in. Like normal chat rooms, it may be created and destroyed repeatedly.

As with Participant objects, we need to ensure the uniqueness of ChatRoom object names. However, since they will possibly be created and destroyed repeatedly over the duration of the federation, HLA's Name Reservation service cannot be used. Thus a ChatRoom's name is not its HLA object instance name, but rather an attribute. Secondly, we need a mechanism to allocate chat room slots without causing any collisions. This is the role of the ChatRoomRegistry object.

Role of the ChatRoomRegistry Object

This unique object stores the list of current name-slot attributions in its single attribute. By subscribing to the single ChatRoomRegistry object instance, each federate keeps its local copy of the list up to date. It is an easy matter to scan the list for any given ChatRoom name to see if it already exists, or to scan the list for the first free slot value. Since only the owner of the list attribute can modify it, there is no risk of several federates attempting to create or delete a ChatRoom object instance simultaneously.

Ownership of the ChatRoomRegistry is used as a means of synchronization between the federates—a sort of baton or token. For example, before a federate can decide whether it needs to create a ChatRoom or not, it will obtain ownership of the ChatRoomRegistry, thus ensuring that there won't be any changes to the list concurrent with its own consultation of the list. In that sense, ownership of an HLA object is similar (at the federation level) to the procurement of a monitor lock on a Java object (at the federate thread level).

The drawback of this approach is that it creates a bottleneck (the ChatRoomRegistry being passed around), but this is an unavoidable consequence of the need for synchronisation. It would have been much worse to introduce a server-like special federate, whose only purpose would be to maintain this list and respond to creation and deletion requests, because this introduces a single point of failure and forces network traffic into a hub-and-spoke pattern.

The ChatRoomRegistry's list attribute may seem superfluous. Since all ChatRooms are known by all federates at all times (by design), each federate is fully capable of maintaining a list of name-slot pairs from those subscriptions alone. This may be true.

On the one hand, this approach would certainly lighten the traffic load somewhat, since there would not be any need to broadcast the entire ChatRoomRegistry list attribute every time it is modified. Note that this is equivalent to breaking up the ChatRoomRegistry object (with its single `ChatRoomRegistryEntries list` attribute) into a series of ChatRoomRegistryEntry objects (each containing a single `ChatRoomRegistryEntry` attribute).

On the other hand, this approach would not improve the federation's resistance to failure (due to RTI events arriving out of sequence). When you obtain an update of the `ChatRoomRegistryEntries` attribute, you can rely on its value to ascertain whether a certain chat room slot is present or not, whereas if you rely on the set of subscribed `ChatRoomRegistryEntry` objects, you can never affirm a slot's absence, as its discovery may very well be pending.

One possible alternate mechanism for achieving this kind of certainty is the federation synchronization service group. A federate would announce its intent to create a chat room at a given slot value by constructing a unique synchronization label from that slot value and attempting to register it. If the registration succeeds, the slot is deemed "reserved" and the federate can proceed with the chat room creation process. When the chat room object is eventually deleted, the deleting federate would assert that synchronization has been achieved (for the synchronization point label corresponding to the slot), and so would the other federates upon receiving the Remove Object Instance callback. In this way the synchronization label would exist as long as the chat room slot is occupied.

Publication and Subscription

We are relying extensively on DDM to achieve the filtering expected of our chat application. Here is how it plays out.

The Communication interaction is sent through either a chat room slot region (one's current chat room) or a user handle slot region (the targeted user). It is subscribed through those same regions *and* through the Waiting Room. This latter subscription serves a single purpose: tripping the interaction scope advisories in order to ascertain whether the federate is "alone" or not. Set up this way, a joined federate will receive a `turnInteractionsOn` when at least one other federate is joined, and will receive a `turnInteractionsOff` when all other federates have resigned. The federate needs to know this when it resigns, in order to decide whether to negotiate the ownership divestiture of objects in its custody, or to destroy the federation behind it. We could also have achieved this by subscribing to the federation's MOM `HLAfederate` objects, but this way is simpler.

The ChatRoomRegistry's attributes are published and subscribed through the default region.

The ChatRooms' attributes are also published and subscribed through the default region.

The Participants' attributes are published through two regions. The first is the "Nowhere" chat room slot. This serves only to ensure that a Participant's publication regions never revert to the default area. The second is the Participant's current chat room slot. When a Participant instance moves between chat room slots, the `[un]associateRegionsForUpdates` service is used to remove it from the old slot and then to add it to the new slot. If the Participant were not also associated with the "Nowhere" slot, it would revert to the default region between its withdrawal and its return. Subscription is through the "Waiting Room" (at all times) and the user's current ChatRoom slot.

Figure 29 shows how Participant objects are distributed in the ChatRoomSlots dimension. Shown in red are those Participant objects which are currently logged-in; each one is owned by the corresponding logged-in federate. Each federate may also own (have custody of) none, one or more of the logged-out Participants, shown in black. Note that logged-out Participants all lie in the Waiting Room slot, and logged-in Participants all lie perforce elsewhere. By subscribing to the chat room slot a federate is currently "in", it knows of the other federates sharing the chat room. By subscribing to the Waiting Room slot, it is readily capable of accepting custody of those Participants should the need arise.

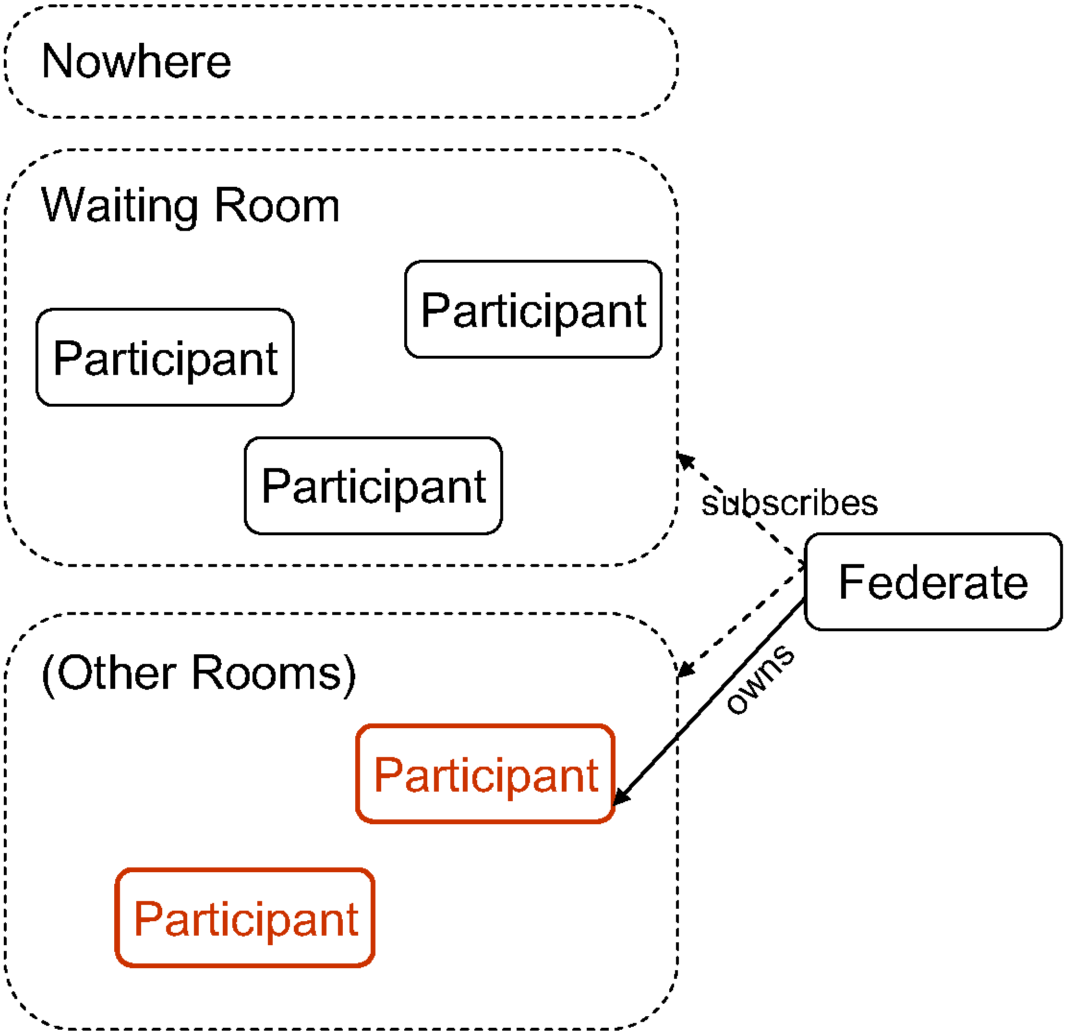


Figure 29. *The Participant objects and the ChatRoomSlots dimension*

Assertions

Each active federate:

- represents a “logged-in” user;
- is “in” one ChatRoom at all times (the General chat room or any one of the user-created chat rooms);
- knows all ChatRoom object instances (the Nowhere room is virtual);
- knows the unique ChatRoomRegistry object instance;
- owns the Participant object instance that bears its user name (and will not relinquish it while logged in);
- knows the Participant object instances that are “in” the same ChatRoom;
- knows the Participant object instances that are dormant (“logged-out”);
- listens to the Communication interaction through a DDM channel corresponding to its user handle slot;
- listens to the Communication interaction through a DDM channel corresponding to its chat room slot; and
- listens to the Communication interaction advisories through a DDM channel corresponding to the Waiting Room slot.

Each Participant object:

- represents a unique (by user name and user slot) federate;
- if “logged-out”, is “in” the Waiting Room and owned by some federate;
- if “logged-in”, is “in” a chat room other than the Waiting Room (e.g. the General chat room or any one of the user-created chat rooms);
- is published through a DDM channel corresponding to its user handle slot;
- is published through a DDM channel corresponding to its chat room slot; and
- is published through a DDM channel corresponding to the Nowhere slot.

When a Participant switches chat rooms, it is simply unassociated from its old chat room slot (so that it is now published only through the Nowhere slot) and then associated with its new chat room slot. When a Participant logs out, it simultaneously switches to the Waiting Room slot. When it logs in, it is either created in the General chat room or switched from the Waiting Room to the General chat room.

Each ChatRoom object:

- represents a unique (by name and slot) chat room;
- is created when a Participant moves “in”; and
- is deleted when the last Participant moves “out.”

Each Communication interaction occurrence:

- represents a message being sent across the chat network;
- if public, is sent through a DDM channel corresponding to the sender’s current chat room slot; and
- if private, is sent through a DDM channel corresponding to the target’s user handle slot.

Federate Life Cycle

Federates are created and initialised in the not-joined state, obviously. They join the federation with the sole intent of logging in. Having joined, their first step is to obtain the values of the various static FOM handles (interaction and object class handles, parameter and attribute handles, dimension handles).

Generally, a federate’s ownership, subscription and publication interests are dynamic and thus a variety of objects are created just before being consumed by an `RTIambassador` service invocation. For example, the Subscribe Object Class Attributes With Regions service consumes an attribute-set region-set pair list, so the federate must generate attribute handle sets and region handle sets. Each region included in the latter forces the federate to generate a dimension handle set, to set the range bounds over each dimension and to commit the region modifications. Although straightforward, these preparations can nevertheless be lengthy.

In our case, the ownership, subscription and publication policies are static, so we generate as many of these objects as possible during initialization: attribute handle sets, dimension handle sets, as well as some of the region handle sets, regions and attribute-set region-set pair lists (i.e. those dealing with the three reserved chat room slots).

The Login Process

The preliminaries consist in publishing and subscribing to the federation’s four classes. First, the federate publishes the Communication interaction class and subscribes to it through the waiting room slot.

Next, the federate publishes the ChatRoomRegistry class and then attempts to reserve the ChatRoomRegistry's name through the Name Reservation service. If the reservation succeeds, the ChatRoomRegistry did not exist and it is the responsibility of this federate to create it. If it fails, the federate simply waits for the object discovery to occur.

The federate repeats the reservation/creation/discovery process for the waiting room. These two objects are the only "fixtures" of the federation.

The federate concludes the login preliminaries by publishing the Participant class and subscribing to Participants in the waiting room.

The login proper then begins. The federate attempts to reserve the chosen username through the Name Reservation service. If the reservation succeeds, the username is new to the federation, so the federate can create the corresponding Participant object and log itself into the general chat room. If it fails, the username already has a corresponding Participant object floating about, which may be logged-in or not.

If logged-out, that Participant will be in the waiting room and will thus be discovered; once discovered, the federate can acquire it (if it does not already own it) and proceed to log it into the general chat room. The login process is then complete.

If logged-in, the Participant will be in the general chat room or some other chat room; even if known the acquisition attempt will fail. At this point the login process is a failure and the federate resigns from the federation.

Although the login process is relatively quick, it does nevertheless take a finite time. The federation runs the risk of putting itself in a pathological state if it had only one joined federate left and it logs out simultaneously with the log in of another. As stated above, the first step of the login process is the publication of the Communication interaction, which triggers an interaction scope advisory at the logging-out federate. The logging-out federate may then tender ownership of its objects (the ChatRoomRegistry, the waiting room ChatRoom and others) to the logging-in federate before the latter has had time to publish the relevant classes, discover the objects and receive their values. Conversely, the logging-out federate could destroy its owned objects before it receives the advisory, and the logging-in federate will then be unable to recreate the federation's standard objects.

Another possible problem is a race for the same pre-existing (logged-out) Participant: if two users attempt to log in at about the same time, the slower one may see the desired object go out of scope (be acquired by the faster federate) after it has already committed itself (after checking for a number of pre-conditions) to wait for the acquisition. Conversely, duplicate ChatRooms (except for the waiting room, which is named) are possible if federates are racing to create them (e.g. both pass the non-existence check points and commit themselves to creating the chat rooms). See the `MyChat.registerParticipant()` code in Annex E for details.

Skilful use of a federation synchronization point could prevent these kinds of race conditions. The very first action a logging-in federate would take would be to register a synchronization point named something like "Login in progress"; other federates would achieve the point immediately, while logging-out federates would await the Federation Synchronized callback before proceeding. A similar "Logout in progress" synchronization point would also be used. These precautions were not taken with this work for expediency's sake.

The Logout Process

As soon as it starts the logout process, the federate sets an internal flag that will have it decline offers of ownership; as discussed in the login process, this could be a problem if all remaining joined federates try to log out simultaneously.

First, the federate proceeds as if switching chat rooms (see below), from the current one to the "waiting room", except that no subscription to the Communication interaction through the latter occurs. While "nowhere", the federate's Participant avatar has its `logged_in` attribute changed in addition to `chat_room_slot`.

The federate unsubscribes from any remaining subscriptions and then, if the interaction scope advisories indicate that there are other joined federates, it negotiates the divestiture of any owned objects to those federates (in order to prevent the potential orphaning of any instances), including, of course, its Participant avatar. Once that is done, any remaining publications can be shut down, and the federate can now resign freely from the federation. The last federate to resign from the federation deletes all objects from the federation and then destroys the federation.

The Chat Room Switching Process

When a user switches chat rooms, the first sub-task is to find out if the new chat room already exists or not. If not, it needs to be created, a fairly simple matter of creating the ChatRoom object and registering it with the federation.

The federate now withdraws its Participant avatar from the current chat room slot, which leaves it published solely through the nowhere room. This means it goes out of scope for all other joined federates. Concurrenty, the federate's subscription to the Communication interaction through the old chat room slot is shut down.

If the chat room left behind becomes empty, it must be deleted. This sub-task entails obtaining ownership of the ChatRoomRegistry in order to update its list of extant chat rooms.

To decide if the chat room is now empty, we count the number of Participant objects (out of the known set) that are in it (according to their `chat_room_slot` attributes). Once that count is secured, the federate can unsubscribe the Participant class from the current chat room (this causes any co-Participants to go out of scope, so attribute updates are no longer received for those).

A race condition exists at this point: it is possible another federate may join the chat room after it has been determined to be empty but before the actual deletion occurs. The solution would be to modify the FOM to add a `count` attribute to the ChatRoom object, which would reflect its occupancy on a continuous basis. A little extra overhead would be incurred as ownership of that attribute gets passed around (whenever a federate joins or leaves the chat room).

The potential deletion process would then be as follows. First, check the chat room's `count`; if greater than 1, no deletion is required and we are done. Otherwise, we must acquire the ChatRoomRegistry (since we intend to strike the chat room from its `list`). Once that is done, check the `count` again, just in case it has changed in the meantime. If deletion is still indicated, obtain ownership of the ChatRoom and check the `count` one last time. If still holding at 1, we can delete it (there is no point in updating the `count` to zero and deleting the object immediately afterwards). Other federates wanting to join the chat room will try to acquire it, so if we receive an ownership release request we will simply ignore it and forge ahead with deletion. This will cause the evocation of RemoveObjectInstance at the other federates, which will tell them "back to square one, the requested ChatRoom doesn't exist any more."

Once the old chat room has been deleted or simply left behind, the federate's Participant avatar has its `chat_room_slot` set locally to the new chat room, and then it is re-associated (published) through the new chat room slot, the Communication interaction is subscribed through the new chat room slot, and the Participant class is subscribed through the new chat room slot (this reveals the co-Participants in the new chat room, if any). The AutoProvide switch means an attribute value update request occurs immediately after the Participant is discovered by or goes back into scope for other joined federates (i.e. those whose Participants already are in the new chat room).

Ownership Transfer Processes

As the federation evolves, it is expected that the ownership of most objects will be transferred repeatedly between the joined federates. The ChatRoomRegistry is passed around whenever a chat room needs to be added or deleted. ChatRoom objects are transferred so that they are always owned by one of the federates "in" that room. Logged-in Participants are each owned by the federate they represent, while logged-out Participants are divested by resigning federates (there are no particular criteria for ownership besides simply being joined).

The process of ownership is straightforward. Each federate receiving a request for ownership assumption checks if it is in the “normal” state (i.e. not in the process of logging out) and that the class is currently subscribed to (because a federate’s local copy of an unsubscribed object is probably outdated as far as the object’s attribute values go). Once these formalities are out of the way, the key step is establishing the to-be-acquired object’s publication regions *before* requesting tentative ownership (using the Attribute Ownership Acquisition If Available service). This ensures continuity of an object’s publication regions. Note that this is applicable only to Participant objects, since all other objects are published through the default region.

When prompted to acquire a ChatRoom object, it is the federate’s responsibility to check if it is fully eligible (i.e. is the chat room being offered either the waiting room or the client’s current chat room?), as the RTI offers ownership to all joined federates that know of the object and that publish its class—a broader criterion.

5. Conclusions

The IEEE 1516 series of standards offers great promise, and is a great improvement over the preceding 1.3 standard. Designing a flexible middleware standard that could accommodate vastly differing simulation contexts without presuming on the underlying semantics was a daunting task, and the IEEE must be congratulated on succeeding at it.

The use of state diagrams is crucial in understanding how each federate and the RTI are expected to work together. They help tremendously in coming to grips with the subtle implications of seemingly innocuous concepts such as “ownership transfer.”

Few blind spots remain with IEEE 1516, and these should be easily remedied by the active IEEE/SISO involvement in evolving the standard. The most obvious one is the need for RTI-supplied standard encoding and decoding facilities for value transport. It is surprising that this need was not recognised (or explained away) in the published standard.

The IRC example application turned out to have rich implications with respect to DDM, potential race conditions, and simultaneous actions (imagine all logged-in users logging out “at once”); being time-less exacerbated some of these. A new appreciation of the federation synchronization services emerges from this.

JACK’s built-in thread management turned out to avoid a slew of potential problems. The Java interface proved very easily adaptable, once the appropriate design decisions were identified.

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Annex A – Notes on the IEEE 1516-2000 Series of Standards

This annex comments on the IEEE 1516-2000 Series of Standards in the same manner as the U.S. Department of Defense (DoD) *Interpretations of the IEEE 1516-2000 series of standards: Release 2* [39].

IEEE 1516-2000 Series

Multiple Federation Executions

The subject of a single federate application running multiple federates, possibly spread over several distinct federate executions, is touched upon only in an indirect way in the 1516 specification. Recall that the RTI can handle several federation executions running at once, and that each federation execution may have any number of joined federates. Each of these is an emanation of a federation application but, although each joined federate is logically distinct, nothing prevents several of them from being emanations of a single federation application instance. This is somewhat analogous to a single instance of a word processing application handling multiple documents at once, each document containing embedded objects that call upon a single third party service (e.g. multimedia clips).

The key reference is the brief mention, in 1516.1-2000, **1.4.3 General nomenclature and conventions**, that "For all joined federate-initiated services in this specification, except Create/Destroy/Join Federation Execution, an implied supplied argument is a joined federate's connection to a federation execution. For all RTI-initiated services, an implied supplied argument is also a joined federate's connection to a federation execution."

In practice, the behaviour implemented by the existing RTIs is the following. The `RTIambassador` interface obtained from the RTI represents implicitly the federate's connection to a federation execution, in the sense that once the federate has joined a federation execution, that particular RTIambassador is *committed* and will throw a `FederateAlreadyExecutionMember` exception if a new Join is attempted, regardless of the specified federation execution, federate type or `FederateAmbassador` instance.

Nothing prevents the federate from obtaining a distinct `RTIambassador` interface and using that to Join the same (or another) federation execution as a logically different federate. Although the specification does permit the same `FederateAmbassador` instance to be used for both Joins, it is extremely unlikely that this will be done intentionally, as the `FederateAmbassador` instance will be hard pressed to know which federation execution is invoking its callbacks, or, in the case where the `FederateAmbassador` instance is used by two federates of the same federation execution, which of the two federates the RTI is sending messages to (and therefore which `RTIambassador` instance the federate application should use in replying).

Unless the `FederateAmbassador` is carefully designed with this mode of operation in mind (setting up thread variables to distinguish between the federate service thread contexts seems required as a start), utter chaos and eventual failure of the federate application is certain to ensue.

Simple Inheritance

A feature common in object-oriented languages is the ability to *hide*, *override* or *overload* an inherited member of a class. In the HLA "objects are defined entirely by their identifying characteristics (attributes) [...] These are, in OO parlance, data members of the class" (1516 1. Overview). Java calls data members *fields* and, consequently, the only pertinent mechanism is *hiding*, wherein one redeclares an inherited field, possibly giving it a different data type. This is not legal in HLA.

Although one can reasonably derive this result from the definitions for the "available/inherited attributes/parameters" (3.1.5; 3.1.7; 3.1.39; 3.1.40) as well as the additional statements 1516.1 1.4.3 ("The handle for a class attribute that is inherited shall be the same as the handle that is assigned to the class attribute in the object class in which it is declared") and 1516.2 4.2.1 ("Subclasses shall always inherit the attributes of their superclasses, and they may possess additional attributes to provide the desired specialization"), the clincher is 1516.2 4.4.2: "The names assigned to attributes of any particular object class shall not duplicate (overload) the names of attributes of this class or any higher level superclass").

It would nevertheless have been useful to mention this more explicitly and earlier. To give but one example of the confusion possible over this point, the Pitch Visual OMT 1516 application, used to create and edit Federation Object Model (FOM) Document Data (FDD) files, allows one to hide inherited fields and nevertheless declares the file as valid when using its Check Consistency tool. It is only when one tries to `createFederationExecution` using the resulting FDD that one gets an `ErrorReadingFDD` exception.

Therefore, change the third paragraph of 1516 (Framework and Rules) 1.3 Relationship of HLA and object-oriented concepts to:

As discussed above, HLA object classes are described by the attributes that are defined for them. These are, in OO parlance, data members of the class. These attributes, which are abstract properties of HLA object classes, are referred to as class attributes. Another important difference between HLA and OOAD concepts is that an inherited class attribute cannot be hidden; that is to say, a class attribute defined at a given class is inherited by its subclasses and may not be redeclared. HLA object instances are spawned via an HLA service using an HLA object class as a template. Each attribute contained by an HLA object instance is called an instance attribute.

Declaring Dimensions

Clause 4.6 of 1516.2 (Object Model Template Specification) describes how one sets up dimensions within the OMT. Interestingly, although dimension upper bounds are described in terms of "non-negative integers", the XML specification expects a string and the range of legal strings is not defined. As a result, the Pitch pRTI 1516 implementation is unable to read correctly an `HLAinteger32BE` or `HLAinteger64BE` dimension because it attempts to translate the string into a Java `int`, whose maximum value is 2^{31}-1 (=2 147 483 647). Since the upper bound is excluded, a full 32-bit dimension would have a range of [0, 2147483648) and pRTI 1516 throws an `ErrorReadingFDD` exception with the message "`Invalid dimension upper bound`." Even if pRTI1516 correctly handled the upper bounds as Java `long`s, which is what the API specifies for its `GetDimensionUpperBound` service, there would be a problem with the largest possible upper bound, which would be 2^{63} (whereas the Java `long` type's upper bound is 2^{63}-1).

Note also that a floating-point dimension is legal, although the upper bound of the RTI view of such a dimension is still specified as a non-negative integer. Considerable quantization will occur if linearly normalizing such floating-point values over spans approaching the full domain. It should be noted, however, that when the bit-widths are the same, the lack of precision inherent in the floating-point representation itself (at large magnitudes) is much worse than that imposed by the quantization.

Encoding/Decoding Values

When sending an interaction or an attribute instance update, the values are expected to be encoded into opaque byte arrays; likewise, a received interaction or attribute instance reflection supplies values as opaque byte arrays. If the values are of certain types, the RTI supplies the `encode` and `decode` methods necessary for the translation. Unfortunately, the standard only specifies eleven datatypes: `AttributeHandle`, `DimensionHandle`, `FederateHandle`, `InteractionClassHandle`, `LogicalTime`, `LogicalTimeInterval`, `ObjectClassHandle`, `ObjectInstanceHandle`, `OrderType`, `ParameterHandle` and `TransportationType`. Clearly, any federates that partake of a given FOM must also share the relevant `encode/decode` methods. Even then, it is not clear which `encode/decode` methods should be used when subscribing to MOM objects and interactions.

Clause 4.12.3 of 1516.2 (Object Model Template Specification) describes, in table 23, the basic data representation formats (`HLAinteger16BE`, `HLAinteger32BE`, `HLAinteger64BE`, `HLAfloat32BE`, `HLAfloat64BE`, `HLAoctetPairBE`, `HLAinteger16LE`, `HLAinteger32LE`, `HLAinteger64LE`, `HLAfloat32LE`, `HLAfloat64LE`, `HLAoctetPairLE`, `HLAoctet`). The following clauses describe the remaining datatypes: simple (`HLAASCIIchar, HLAunicodeChar, HLAbyte`), enumerated (`HLAboolean`), fixed array (none mandated), variable array (`HLAASCIIstring, HLAunicodeString, HLAopaqueData`), fixed record (none mandated) and variant record (none mandated). Note that a user-defined datatype could be an arbitrarily complex construct (e.g. a variable array of variant records). The byte array representations are specified in detail later on, at clause 4.12.9. However, no `encode/decode` methods are supplied, opening the door to inefficient or erroneous implementations.

Note also that 1516.1 11.6 (MOM OMT Tables) defines a number of additional datatypes that would need to be supported if one were to make full use of the MOM:

- Simple: `HLAcount, HLAfederateHandle, HLAmsec,` and `HLAseconds`

- Enumerated: `HLAfederateState, HLAorderType, HLAownership, HLAresignAction, HLAserviceGroupName, HLAswitch, HLAsyncPointStatus,` and `HLAtimeState`

- Variable Array: `HLAargumentList, HLAhandle, HLAhandleList, HLAinteractionCounts, HLAinteractionSubList, HLAlogicalTime, HLAobjectClassBasedCounts, HLAsyncPointFederateList, HLAsyncPointList, HLAtimeInterval,` and `HLAtransportationName`

- Fixed Record: `HLAinteractionCount, HLAinteractionSubscription, HLAobjectClassBasedCount,` and `HLAsyncPointFederate`

The RTI Ambassador ought to supply factories for each and every one of the OMT-described datatypes, so that a common set of `encode/decode` methods may be used throughout the federation. This could be done through a single `RTIambassador` support service along the lines of `DataTypeInterface GetDatatypeInstance(String DatatypeName)`, where `DataTypeInterface` would include methods such as `getIntValue()`, `setIntValue(int value)`, `encode(byte[] [, offset])`, `decode(byte[] [, offset])`, `getName()`, `getDatatypeType()` (simple, enumerated, `HLAfixedArray`, `HLAvariableArray`, `HLAfixedRecord`, `HLAvariantRecord`) and so on. Each federate could then obtain an encoding/decoding interface from the RTI for any arbitrary datatype declared in the FDD, and be assured that any values transmitted as part of an interaction or attribute value update will be correctly interpreted by the other federates. Until such an extension to the IEEE 1516 specification appears, one is forced to implement separately the encoding scheme as laid out in 1516.2 4.12.9 (Predefined encodings for constructed datatypes).

We believe one of the SISO HLA Product Development Groups (PDGs) is working on precisely this problem (SISO has recently become the custodian of HLA at IEEE's behest).

Names

The only part of the standard that defines what is an allowable name is 1516.2 (Object Model Template Specification), at clause 3.3.1. Even then, the clause omits to state whether the definition applies to object instance names, presumably because these are the only designators not appearing in the FOM Document Data (FDD). The `IllegalName` exception thrown by the `reserveObjectInstanceName` service is laconically described as occurring when "the name argument begins with "HLA"." This is obviously incomplete. Assuming that the 1516.2 rules apply, add to clause 3.1 (Definitions) the following (renumbering subsequent definitions accordingly):

3.1.52 name: A human-readable hopefully significant character string used to designate an object or interaction class, an attribute, a parameter, a datatype (including enumerators and enumerated values), a record field, a dimension, a transportation or ordering type, a synchronization point or federation save label, a federation execution, a federate type, or an object instance. There are two forms of names: simple names and qualified names. A qualified name consists of a name, a "." (period [Unicode $002E]), and a simple name. They are used to designate object and interaction classes by tracing their ancestry from their respective root classes. Simple names are constructed from a combination of letters (Latin letters "A" through "Z" [Unicode $0041 through $005A] and "a" through "z" [Unicode $0061 through $007A]), digits ("0" through "9" [Unicode $0030 through $0039]), hyphens [Unicode $002D], and underscores [Unicode $005F]. A simple name cannot begin with a digit or hyphen. Case is significant. The name "na" and all names beginning with "HLA" (including all case variations in both instances) are reserved.

Examples:

HLAfederate	is a simple name (from the MOM)
HLAobjectRoot.HLAmanager.HLAfederate	is a qualified name
hLa-Immunological-Complex	is an illegal name ("hla" prefix reserved)
h-L-a-Immunological-Complex	is a legal name
nA	is an illegal name ("na" reserved)
nA_nanoampere	is a legal name

Note that the definition proposed above is more restrictive than clause 1516.2 3.3.1 as it allows only the ASCII subset. If one wishes to allow the full XML 1.1 [40] gamut, it should be explicitly listed:

A simple name consists of a NameStartChar followed by zero or more NameChar.

The set of NameStartChars consists of the following Unicode characters:
- the colon (':'), $003A;
- the upper case Latin letters 'A' through 'Z' inclusive, $0041-$005A;
- the underscore '_', $005F;
- the lower case Latin letters 'a' through 'z' inclusive, $0061-$007A;
- the accented Latin letters up to and including the spacing modifier letters (except the multiplication and division signs), $00C0-$00D6, $00D8-$00F6, and $00F8-$02FF;
- the Greek letters (except the Greek question mark), $0370-$037D, $037F-$1FFF; and
- a wide selection of other characters: $200C-$200D, $2070-$218F, $2C00-$2FEF, $3001-$D7FF, $F900-$FDCF, $FDF0-$FFFD, and $10000-$EFFFF.

The set of NameChars consists of the set of NameStartChars plus the following supplementary Unicode characters:
- the hyphen '-', $002D;
- the digits '0' through '9' inclusive, $0030-$0039;
- the mid-dot '·', $00B7;
- the diacriticals $0300-$036F; and
- the general punctuation signs undertie '‿' and character tie '⁀', $203F-$2040.

While on the subject of names and labels, it seems odd that various services which accept String input (such as createFederationExecution, requestFederationSave, etc.) do not throw IllegalName-like exceptions when the supplied String violates the name construction rules. The only services (in addition to reserveObjectInstanceName) that currently do throw such exceptions are 10.18 getTransportationType and 10.20 getOrderType.

To give an example of the pathologies that may arise as a consequence of this omission, consider that, as the standard is currently written, an RTI must accept any form of save or synchronization label, including ones with embedded control or line break characters. If an RTI simply filters these out, then the situation occurs where two federation-defined labels considered different by the federation (because control characters differ or are placed differently within the label) are treated as congruent by the RTI.

Therefore, add the following exceptions (it may be useful to define all of these new exceptions as subclasses of `IllegalName`):

```
// 4.2
[…] createFederationExecution […]
   throws IllegalFederationExecutionName […]

// 4.3
[…] destroyFederationExecution […]
   throws IllegalFederationExecutionName […]

// 4.4
[…] joinFederationExecution […]
   throws IllegalFederateType, IllegalFederationExecutionName […]

// 4.6
[…] registerFederationSynchronizationPoint […]
   throws IllegalLabel […]

// 4.9
[…] synchronizationPointAchieved […]
   throws IllegalLabel […]

// 4.11
[…] requestFederationSave […]
   throws IllegalLabel […]

// 4.18
[…] requestFederationRestore […]
   throws IllegalLabel […]

// 6.2
[…] reserveObjectInstanceName […]
   throws IllegalObjectInstanceName […]

// 6.4
[…] registerObjectInstance […]
   throws IllegalObjectInstanceName […]

// 9.5
[…] registerObjectInstanceWithRegions […]
   throws IllegalObjectInstanceName […]

// 10.2
[…] getObjectClassHandle […]
   throws IllegalObjectClassName […]

// 10.4
[…] getAttributeHandle […]
   throws IllegalAttributeName […]
```

```
// 10.6
[…] getInteractionClassHandle […]
   throws IllegalInteractionClassName […]

// 10.8
[…] getParameterHandle […]
   throws IllegalParameterName […]

// 10.10
[…] getObjectInstanceHandle […]
   throws IllegalObjectInstanceName […]

// 10.12
[…] getDimensionHandle […]
   throws IllegalDimensionName […]

// 10.18
[…] getTransportationType […]
   throws IllegalDimensionName […]
```

IEEE 1516.1-2000: Federate Interface Specification

1.4.3 General nomenclature and conventions

Replace:

For all joined federate-initiated services in this specification, except 4.2, Create Federation Execution, 4.3, Destroy Federation Execution, and 4.4, Join Federation Execution, an implied supplied argument that is a joined federate's connection to a federation execution.

With:

For all joined federate-initiated services in this specification, except 4.2, Create Federation Execution, 4.3, Destroy Federation Execution, and 4.4, Join Federation Execution, an implied supplied argument is a joined federate's connection to a federation execution.

4.4 Join Federation Execution

The consequences of the "implied supplied arguments" mentioned in 1.4.3 are worked out incorrectly in the Join Federation Execution service description as currently written. To the first paragraph, add:

[…] Until the Resign Federation Execution service is invoked by the federate, the RTIambassador interface instance used to invoke this service is considered *committed* to the specified federation execution. Although the 4.1 Create Federation Execution and 4.2 Destroy Federation Execution services may still be freely invoked, any invocation of this service while committed will fail, regardless of the explicitly supplied arguments.

Change 4.4.3 b) to read:

b) The federate is not joined to any federation execution.

Change 4.4.5 a) to read:

a) The federate is already joined to a federation execution.

5.2/5.3 [Un]Publish Object Class Attributes

The Annex B `RTIambassador.java` file introduces a potentially dangerous source of confusion when it labels (on five occasions) an `AttributeHandleSet` argument "`attributeList`". The Java class `java.util.List` is quite different from the `java.util.Set` class. Therefore, replace:

```
// 5.2
public void publishObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet attributeList)
[…]
// 5.3
public void unpublishObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet attributeList)
[…]
// 5.6
public void subscribeObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet attributeList)
[…]
public void subscribeObjectClassAttributesPassively (
 ObjectClassHandle  theClass,
 AttributeHandleSet attributeList)
// 5.7
[…]
public void unsubscribeObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet attributeList)
[…]
```

With:

```
// 5.2
public void publishObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet theAttributes)
[…]
// 5.3
public void unpublishObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet theAttributes)
[…]
// 5.6
public void subscribeObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet theAttributes)
[…]
public void subscribeObjectClassAttributesPassively (
 ObjectClassHandle  theClass,
 AttributeHandleSet theAttributes)
// 5.7
[…]
public void unsubscribeObjectClassAttributes (
 ObjectClassHandle  theClass,
 AttributeHandleSet theAttributes)
[…]
```

5.6/5.7 [Un]Subscribe Object Class Attributes

See 5.2/5.3 [Un]Publish Object Class Attributes, above.

5.8/5.9 [Un]Subscribe Interaction Class

The Annex B `RTIambassador.java` file introduces a minor source of confusion when it labels (on eight occasions) an `InteractionClassHandle` argument "`theClass`", a name used everywhere else to designate an `ObjectClassHandle`. Other services use "`theInteraction`" for `InteractionClassHandle` arguments. Therefore, replace:

```
// 5.8
public void subscribeInteractionClass (
 InteractionClassHandle theClass)
[…]
public void subscribeInteractionClassPassively (
 InteractionClassHandle theClass)
[…]
// 5.9
public void unsubscribeInteractionClass (
 InteractionClassHandle theClass)
[…]
// 6.14
public void changeInteractionTransportationType (
 InteractionClassHandle theClass,
 TransportationType     theType)
[…]
// 8.24
public void changeInteractionOrderType (
 InteractionClassHandle theClass,
 OrderType              theType)
[…]
// 9.10
public void subscribeInteractionClassWithRegions (
 InteractionClassHandle theClass,
 RegionHandleSet        regions)
[…]
public void subscribeInteractionClassPassivelyWithRegions (
 InteractionClassHandle theClass,
 RegionHandleSet        regions)
[…]
// 9.11
public void unsubscribeInteractionClassWithRegions (
 InteractionClassHandle theClass,
 RegionHandleSet        regions)
[…]
```

With:

```
// 5.8
public void subscribeInteractionClass (
 InteractionClassHandle theInteraction)
[…]
public void subscribeInteractionClassPassively (
 InteractionClassHandle theInteraction)
[…]
// 5.9
public void unsubscribeInteractionClass (
 InteractionClassHandle theInteraction)
[…]
// 6.14
public void changeInteractionTransportationType (
 InteractionClassHandle theInteraction,
 TransportationType     theType)
[…]
// 8.24
public void changeInteractionOrderType (
 InteractionClassHandle theInteraction,
 OrderType              theType)
[…]
// 9.10
public void subscribeInteractionClassWithRegions (
 InteractionClassHandle theInteraction,
 RegionHandleSet        regions)
[…]
public void subscribeInteractionClassPassivelyWithRegions (
 InteractionClassHandle theInteraction,
 RegionHandleSet        regions)
[…]
// 9.11
public void unsubscribeInteractionClassWithRegions (
 InteractionClassHandle theInteraction,
 RegionHandleSet        regions)
[…]
```

6.1 Overview

To clarify the important distinction between known and owned object instances, insert this paragraph after the one on orphan object instances (p. 71):

However, an object instance can become wholly unowned without becoming an orphan. It is important to note that object instances that are known remain known even if they become undiscoverable. As long as a joined federate that knows of the object instance does not invoke Local Delete Object Instance, it continues to know of the object instance and ownership acquisition of some or all of the latter's instance attributes remains possible.

6.3 Object Instance Name Reserved

A clarification is needed as to whether deleting an object instance frees up its object instance name for re-use. The text of clause 6.3 implies that it does not: "[...] no joined federate joined to the current federation execution shall subsequently receive a successful reservation for that name". That is certainly the way the Pitch pRTI1516 interprets it. Under certain circumstances, this behaviour is undesirable. For instance, if a reserved name is used to represent a "username token", then that username cannot be re-used (after a "log-off", say) for the remainder of the federation execution.

Also, replace the first sentence:

Notifies the joined federate whether the name provided in a previous invocation of `Register Object Instance Name` service has been reserved, which shall mean that the name is federation execution-wide unique.

With:

Notifies the joined federate whether the name provided in a previous invocation of `Reserve Object Instance Name` service has been reserved, which shall mean that the name is federation execution-wide unique.

6.7 Reflect Attribute Values

In all forms, it seems odd that the federate is not allowed to throw the `InvalidOrderType` or `InvalidTransportationType` exceptions. When the service conveys a `MessageRetractionHandle`, the `InvalidMessageRetractionHandle` exception should be expected. According to the specification, the two forms that convey a `LogicalTime` and are allowed to throw the `InvalidLogicalTime` exception should do so only if the received ordering is TIMESTAMP.

These problems are common to the C++ and Java annexes.

6. 10/6.12 [Local] Delete Object Instance

The Annex B `RTIambassador.java` file introduces a minor source of confusion when it labels (on three occasions) an `ObjectInstanceHandle` argument "`objectHandle`". The other services all use "`theObject`". Therefore, replace:

```
// 6.10
public void deleteObjectInstance (
 ObjectInstanceHandle objectHandle,
 byte[]               userSuppliedTag)
[…]
public MessageRetractionReturn deleteObjectInstance (
 ObjectInstanceHandle objectHandle,
 byte[]               userSuppliedTag,
 LogicalTime          theTime)
[…]
// 6.12
public void localDeleteObjectInstance (
 ObjectInstanceHandle objectHandle)
[…]
```

With:

```
// 6.10
public void deleteObjectInstance (
 ObjectInstanceHandle theObject,
 byte[]               userSuppliedTag)
[…]
public MessageRetractionReturn deleteObjectInstance (
 ObjectInstanceHandle theObject,
 byte[]               userSuppliedTag,
 LogicalTime          theTime)
[…]
// 6.12
public void localDeleteObjectInstance (
 ObjectInstanceHandle theObject)
[…]
```

6.14/8.24 Change Interaction Transportation/Order Type

See 5.8/5.9 [Un]Subscribe Interaction Class, above.

7.3 Negotiated Attribute Ownership Divestiture

The description is incomplete. As the DoD Interpretations clearly indicate, the Unconditional Attribute Ownership Divestiture service is a fifth, legal way to "divest ownership by other means." The second paragraph is thus replaced by[1]:

A request to divest ownership shall remain pending until the request is completed (via the *Request Divestiture Confirmation †* and *Confirm Divestiture* services), or the requesting joined federate successfully cancels the request (via the *Cancel Negotiated Attribute Ownership Divestiture* service), or the joined federate divests itself of ownership by other means (i.e. the *Attribute Ownership Divestiture If Wanted, Unconditional Attribute Ownership Divestiture* or *Unpublish Object Class Attributes* services). A second negotiated divestiture for an instance attribute already in the process of a negotiated divestiture shall not be legal.

9.5 Register Object Instance With Regions

The Annex B `RTIambassador.java` file introduces a minor source of confusion when it labels a `String` argument "`theObject`". The Register Object Instance service uses, more appropriately, "`theObjectName`". Therefore, replace:

```
// 9.5
[…]
public ObjectInstanceHandle registerObjectInstanceWithRegions (
 ObjectClassHandle             theClass,
 AttributeSetRegionSetPairList attributesAndRegions,
 String                        theObject)
[…]
```

With:

```
// 9.5
[…]
public ObjectInstanceHandle registerObjectInstanceWithRegions (
 ObjectClassHandle             theClass,
 AttributeSetRegionSetPairList attributesAndRegions,
 String                        theObjectName)
[…]
```

[1] In the IEEE 1516 documents, the printer's dagger (†) is used to denote the callbacks; that is to say, the federate-implemented, RTI-initiated services.

9.10/9.11 [Un]Subscribe Interaction Class With Regions

See 5.8/5.9 [Un]Subscribe Interaction Class, above.

Logical Time, Time Stamps, and Lookahead

(pp. 259+) The definitions given for the Java interfaces `LogicalTime, LogicalTimeInterval, LogicalTimeFactory` and `LogicalTimeIntervalFactory` suffer from a number of inconsistencies when one compares the 12.4.2.23 clause with the (normative) Java API supplied by Annex B. There are further inconsistencies when one compares the Java clause and annex with the corresponding C++ and Ada 95 clauses and annexes. Specifically:

Interpretation 1

According to 12.4.2.23, "Methods [...] are provided [...] to set an instance to the initial and final [Logical Time] values. A method to set one instance to the same value as another is provided as well". The C++ and Ada 95 clauses (12.5.2.23 and 12.3.2.24, respectively) describe the same methods and their Annexes (C - `LogicalTime.h` and A, respectively) declare them (e.g. for C++: `setInitial`, `setFinal` and `setTo`). By contrast, the Java API is missing three methods from its `LogicalTime` interface:

```
/**
 * Sets the value to <code>initialTime</code>.
 */
public void setInitial();

/**
 * Sets the value to <code>finalTime</code>.
 */
public void setFinal();

/**
 * Sets the value to equal the <code>other</code>'s.
 * @param other A <code>LogicalTime</code> whose value is
 *             used to set <code>this</code>
 * @throws InvalidLogicalTime
 */
public void setTo(LogicalTime other)
   throws InvalidLogicalTime;
```

Interpretation 2

The Ada 95 clause (12.3.2.24) is the only one that reads "one instance of a Logical_Time may be subtracted from another, but not added. The result is of type Logical_Time_Interval". On the other hand, all three annexes define the method (e.g. "subtract" for C++ and "distance" in Java). Thus the C++ clause (12.5.2.23) should have this sentence added to its third paragraph:

Finally, a method is provided to obtain the RTI::LogicalTimeInterval separating two instances of RTI::LogicalTime.

And the Java clause (12.4.2.23) should have this sentence added to its third paragraph:

Finally, a method is provided to obtain the LogicalTimeInterval separating two instances of LogicalTime.

Interpretation 3

The LogicalTimeFactory is described as having "[...] a method to create a LogicalTime instance whose value is the user-defined initial value". The notion of "user" is misleading; replace the sentence (in the Java and C++ clauses) with:

The LogicalTimeFactory interface has a method to create a LogicalTime instance whose value is the federate-developer-defined initial value.

Interpretation 4

The aforementioned LogicalTimeFactory method is described in the C++ (12.5.2.23) and Java (12.4.2.23) clauses, while the Ada 95 clause (12.3.2.24) is mute on the subject, the concept of Factory class being alien to that language. Annex C - LogicalTimeFactory.h declares makeInitial as expected. Java's Annex B, however, declares *two* Factory methods, makeInitial and makeFinal. Either the extraneous Java method should be deleted from the interface, or the specification should be enhanced to include the makeFinal method for C++.

Interpretation 5

The `LogicalTime` manipulation methods bear radically different names in each API:

Ada	*Java*	*C++*
+	`add`	`increaseBy`
-	`subtract`	`decreaseBy`
-	`distance`	`subtract`

One must question the wisdom of such inconsistencies, since most other method names are immediately recognizable between APIs (e.g. `Set_To_Epsilon` vs. `setEpsilon` vs. `setEpsilon`).

Interpretation 6

The description of `LogicalTimeInterval` should stress that it is used to represent strictly non-negative values; that is to say, it represents the *magnitude* of a logical time interval. This is crucial for the proper implementation of such methods as C++'s `LogicalTime.increaseBy`, `LogicalTime.decreaseBy`, `LogicalTime.subtract` and `LogicalTimeInterval.subtract`. The `LogicalTimeInterval` constructor supplied in sub-clause B.3 should be modified consequently:

```
ExampleLogicalTimeInterval(long value)
{
   _value = java.lang.Math.abs(value);
}
```

Interpretation 7

The behaviour of `LogicalTimeInterval.subtract` is undefined when the subtrahend is greater than the current object. We can either throw an `IllegalTimeArithmetic` exception or the `InvalidLogicalTimeInterval` exception which the C++ API throws (and which is re-introduced by Interpretation 11, below):

```
/**
 * Returns a new <code>LogicalTimeInterval</code> whose value is
 * <code>(this - subtrahend)</code>.
 * @param subtrahend The <code>LogicalTimeInterval</code> to
 *                   subtract from <code>this</code>
 * @throws InvalidLogicalTimeInterval if the
 *                   <code>subtrahend</code> is larger
 *                   than the value
 */
public LogicalTimeInterval
subtract(LogicalTimeInterval subtrahend)
   throws InvalidLogicalTimeInterval
{
   if (_value < ((LogicalTimeInterval)subtrahend)._value)
      throw new InvalidLogicalTimeInterval()
   else
      return new LogicalTimeInterval(
       _value - ((LogicalTimeInterval)subtrahend)._value);
}
```

Interpretation 8

In both the Java and Ada clauses, `LogicalTimeInterval` has "methods to set a `LogicalTimeInterval` instance to zero or epsilon and to test an instance to determine if it is zero or epsilon". Erroneously, the C++ clause omits the epsilon-related methods, while the annex omits just the `setEpsilon` method:

```
virtual
void
setEpsilon() = 0;
```

Interpretation 9

Again on the `LogicalTimeInterval` "methods to set a `LogicalTimeInterval` instance to zero or epsilon", the Java annex omits these methods from the interface:

```
/**
 * Sets the value to <code>zero</code>.
 */
public void setZero();

/**
 * Sets the value to <code>epsilon</code>.
 */
public void setEpsilon();
```

Interpretation 10

In all three clauses, the description of the `LogicalTimeInterval` methods establishes the analogy with the `LogicalTime` methods but does not explicitly mention a "method to set a `LogicalTimeInterval` instance to the same value as another". This should be corrected.

Interpretation 11

The aforementioned `LogicalTimeInterval` methods "to set a `LogicalTimeInterval` instance to the same value as another" appear in the Ada and C++ annexes but not in the Java annex:

```
/**
 * Sets the value to equal the <code>other</code>'s.
 * @param other A <code>LogicalTimeInterval</code> whose value
 *              is used to set <code>this</code>
 * @throws InvalidLogicalTimeInterval
 */
public void setTo(LogicalTimeInterval other)
   throws InvalidLogicalTimeInterval;
```

Note that this means `InvalidLogicalTimeInterval` must be added to the existing set of `RTIexception`s (this exception is already thrown by the C++ API).

Interpretation 12

The Java LogicalTimeIntervalFactory is simply described as "completely analogous to its LogicalTime counterpart". However, the C++ description mentions "one more method [...which] returns a constant reference to [epsilon]". Annex C - LogicalTimeIntervalFactory.h contradicts this by declaring epsilon as returning an RTI::LogicalTimeInterval instance. Clearly the analogy with RTI::LogicalTimeFactory would be much more consistent. Thus RTI::LogicalTimeIntervalFactory should have two methods, makeZero and makeEpsilon. Thus (C++):

```
virtual
RTI::auto_ptr< RTI::LogicalTimeInterval >
makeEpsilon() = 0;
```

Interpretation 13

In 12.4.2.23 Logical time, time stamps, and lookahead, the last bullet of the list of logical time interfaces to be implemented by RTI providers incorrectly begins with: "An implementation of LogicalTimeIntervalFactory called Integer64TimeIntegerFactory". Change the sentence to: "An implementation of LogicalTimeIntervalFactory called Integer64TimeIntervalFactory".

Annex B: Java application programmer's interface

One of the strengths of the Java language is the Javadoc self-documentation convention. Besides being directly consultable, the Javadoc is typically exploited directly by most Integrated Development Environments (IDEs), and developers have to come to rely on it extensively as a productivity aid. It is therefore regrettable that the Annex B API omits most of these, particularly since the API is said to be *normative*. Adding the requisite comment lines is a time-consuming task, but it does have the virtue of leaving the compiled byte-code unchanged.

An API with the Javadoc comments integrated into it is supplied in one of the other annexes to this report.

Annex B: Java application programmer's interface - InvalidFederateHandle

This exception was introduced with the `normalizeFederateHandle` Java service. One notes, however, that it could also have been added to the list of exceptions thrown by the `registerFederationSynchronizationPoint` service when a `FederateHandleSet` is supplied. Currently, it seems that when an invalid handle is part of the supplied `FederateHandleSet` the RTI invokes `synchronizationPointRegistrationFailed` with the `SYNCHRONIZATION_SET_MEMBER_NOT_JOINED` reason (ref: *DoD Interpretations, Release 2*, **Appendix A, Service 4.6**: Register Federation Synchronization Point (*Clarification 1*)). The rationale behind this decision is probably the impossibility of distinguishing between an "invalid federate handle" and the "valid" federate handle of a now-unjoined federate.

Annex B: Java application programmer's interface - MessageRetractionReturn

The Java `MessageRetractionReturn` class is similar to the `TimeQueryReturn` class, except that it omits the `toString`, `equals` and `hashCode` methods. There is no good reason to do this. Therefore:

Interpretation 1

Add, in the `MessageRetractionReturn.java` file, the lines:

```
/**
 * Returns a <code>String</code> representation of the
<code>MessageRetractionReturn</code>.
 * @return String with value "&lt;retractionHandleIsValid&gt;
&lt;handle&gt;"
 */
public String toString()
{
   return retractionHandleIsValid + " " + handle;
}
```

```
/**
 * Returns true iff <code>this</code> and <code>other</code> represent
the same message retraction return.
 * @param other The <code>Object</code> to compare with
 * @return true iff supplied <code>other</code> is of type
<code>MessageRetractionReturn</code> and has same value
 */
public boolean equals(Object other)
{
   if (other instanceof MessageRetractionReturn)
   {
      MessageRetractionReturn mrrOther =
(MessageRetractionReturn)other;
      if ((retractionHandleIsValid == false) &&
(mrrOther.retractionHandleIsValid == false))
         return true
      else if ((retractionHandleIsValid == true) &&
(mrrOther.retractionHandleIsValid == true))
         return handle.equals(mrrOther.handle)
      else
         return false;
   } else
      return false;
}

/**
 * Returns a hash code for <code>this</code>; two
<code>MessageRetractionReturn</code>s for which <code>equals()</code>
is <code>true</code> should yield the same hash code.
 * @return An <code>int</code> hash code
 */
public int hashCode()
{
   return (retractionHandleValid ? handle.hashCode() : 7);
}
```

Annex B: Java application programmer's interface - Service Groups

The Java implementation of the `ServiceGroup` class uses internally the values 4 through 10 to represent the service groups. These values are accessible through the class's `toString()` method which will return, for example, "`ServiceGroup(4)`" for the `FEDERATION_MANAGEMENT` service group. On the other hand, the Management Object Model (MOM) clearly states (Table 11) that it uses the values 0 through 6 for the same purpose. The potential for confusion is there. The fix is simple:

Interpretation 1

Replace, in the `ServiceGroup.java` file, the line:

```
private static final int _lowestValue = 4; //fedn mgt is chapter 4
```

With:

```
//initial value for enumeration:
//MOM uses 0 for federation management service group
private static final int _lowestValue = 0;
```

D.8.1 [Time Management] Overview

Interpretation 1

Replace the last paragraph:

Additionally, each of the language APIs also provide default concrete implementations of these two ADTs based on the float 64-datatype.

With:

Additionally, each of the language API **Examples** subclauses also provides a default concrete implementation of these two ADTs based on the integer-64 data type.

IEEE 1516.2-2000: Object Model Template (OMT) Specification

4.4.2 [Attribute] Table Format

Replace paragraph 14 (page 30):

The eighth column (Available dimensions) shall record the association of the class attribute with a set of dimensions if a federate or federation is using DDM services for this attribute. The column shall contain a comma-separated list of names of rows in the dimension table described in 4.6. [...]

With (emphasis added for readability):

The eighth column (Available dimensions) shall record the association of the class attribute with a set of dimensions if a federate or federation is using DDM services for this attribute. The column shall contain a **space**-separated list of names of rows in the dimension table described in 4.6. [...]

Table 8 (p. 31) is also incorrect in showing a comma in the `Food.Drink.Soda` Available dimensions column. The same error also appears on p. 32, 4.5.2 [Parameter] Table Format, paragraph 5:

The fourth column (Available dimensions) shall record the association of an interaction class with a set of dimensions if the federate or federation is using DDM services for this interaction. The column shall contain a comma-separated list of names of rows from the dimension table described in 4.6. [...]

Which becomes (emphasis added for readability):

The fourth column (Available dimensions) shall record the association of an interaction class with a set of dimensions if the federate or federation is using DDM services for this interaction. The column shall contain a **space**-separated list of names of rows from the dimension table described in 4.6. [...]

Annexes D and E indeed use space-separated dimension lists (see pp. 82 [`Food.Drink.Soda` object class] and 111 [`HLAreportServiceInvocation` interaction class]). Table 7 of IEEE 1516.1-2000, 11.6 MOM OMT Tables, page 224 is correct.

4.6 Dimension Table

In 1516.1 9.1.4, it was stated that "The normalization of federation data to [0, a particular dimension's upper bound) for use with DDM services shall be left to the federation." This is, besides Table 8 in 11.6 MOM OMT Tables, the *only* mention of normalization in the Federate Interface Specification. Buried here in the fourth paragraph is the sentence "The federate shall provide a normalization function for each dimension, that maps values from the federate view of a dimension to values in the RTI view of a dimension." This requirement is undecidable, as there is no member of the `FederateAmbassador` interface, nor any part of the `hla.rti1516` package, that mentions these normalization functions. A federate has no means whatsoever of providing the RTI (or any other federate) with the "required" normalization functions.

The only guidance supplied for their implementation is 1516.2's Annex B, which lays out common normalization functions (so the algorithms are known), and the RTIambassador's Normalize Federate Handle and Normalize Service Group services (so the general declaration form is known).

Is a mechanism for sharing normalization functions between federates desirable? On the one hand, having each federate's view of a dimension be a private implementation matter is a good thing, allowing each federate to choose the internal representation that best suits its purpose and capabilities. On the other hand, if the federation semantics are such that federate views are to be shared (they could be transmitted as object attribute values or as interaction parameters, for example), then a common approach to normalization is highly desirable. Providing a normalization function sharing mechanism allows both cases to be handled, whereas the absence of such a mechanism (which is the current situation) essentially forces the federation semantics into the mould of the first case.

Normalization sharing is not an obvious extension of the `RTIambassador` and `FederateAmbassador` interfaces. Should the value(s) to be normalized be passed like interaction parameters or object attribute values? Will the HLA rules really require that a federate ask itself to normalize a value through the RTI (when it happens to be the "normalizer")? How will federates indicate their normalizing responsibility? How will the RTI allow multiple federates to normalize for a given dimension handle (in order to allow differing views for different federate types)? How can a single method-callback pair encapsulate the various normalization schemes possible?

The RTI-provided normalization services (`normalizeFederateHandle` and `normalizeServiceGroup`) are problematic examples: they introduce two new `RTIexception` descendents, specific to those two services alone: `InvalidFederateHandle` and `InvalidServiceGroup`. This is not an example that federates can follow, if only because there is no way to introduce a new exception class to an existing interface.

One also notes that the federate view of a dimension is not necessarily integer like the RTI view. The linear normalization, for example, could operate from a floating-point federate view. This means the normalization API must be able to accept integer as well as floating-point domain specifications. It is less obvious whether the logarithmic and hyperbolic tangent normalization functions should exist in an integer form besides the floating-point one. In all cases, it is reasonable to assume that the value to normalize is of the same type as the domain's upper and lower bounds.

Looking more closely at the RTIambassador's 10.32 Set Range Bounds service, it is clear that the normalization functions are to be used in converting the federate's view of the range bounds into values usable by the `RangeBounds` constructor (RTI view values). However, what is the federate to make of the values returned by the 10.31 Get Range Bounds service? They need to be converted back into the federate's view of the dimension. Hence, *unnormalization functions* are also required.

Normalization and unnormalization algorithms must be defined in tandem such that, as a general rule, normalizing and then unnormalizing a given value leaves it unchanged (as long as the dimension and domain remain the same, of course). When the RTI view has grosser quantization than the federate view (e.g. the federate domain is 64-bit integer but the RTI dimension is merely 32-bit integer), or when the federate view is floating-point, some degeneracy (binning) of federate view values is expected, but no drift should occur—that is to say, the federate value should not change on a second normalization-unnormalization round-trip.

Enumerated datatypes raise a different kind of issue. The API-defined enumerated types (OrderType, ResignAction, RestoreFailureReason, RestoreStatus, SaveFailureReason, SaveStatus, ServiceGroups, SynchronizationPointFailureReason, and TransportationType) as well as the OMT-defined enumerated datatypes (HLAfederateState, HLAtimeState, HLAownership, HLAresignAction, HLAorderType, HLAswitch, HLAsyncPointStatus, HLAserviceGroupName, plus any user-defined types) are implemented as classes with prototype static field instances. In the absence of a structured hierarchy of datatype interfaces, a generic linear enumerated normalization method, using a class reference argument, must use Java's introspection methods to extract the prototype instances, and must also rely on the hashCode method for the RTI view values.

B.1 Linear normalization function

Since the RTI view is integer, either the result of the equation as written needs to be rounded or truncated, or the division operator must be replaced by an integer division and the parentheses re-arranged. The floor() operation used here is such that it returns the largest integer which is smaller than or equal to its argument. Note that the expression is the same whether the domain itself is integer or floating-point.

Function floor([{domain – domainLower} / {domainUpper – domainLower}] * [DUB – 1])

Or:

Function [(domain – domainLower) * (DUB – 1)] div (domainUpper – domainLower)

Where DUB is, as 1516.2-2000, Annex B, states, "the dimension upper bound specified for the dimension in the third column of Table 11."

B.1.1 Linear unnormalization function

To properly invert the normalization function when the domain is integer, we define the ceiling() operation such that it returns the smallest integer which is larger than or equal to its argument. This expression and the corresponding normalization function work correctly when the domain range (domainUpper – domainLower) is larger or smaller than the dimension range (DUB – 1), and also whether the domain extends over the negative integers or not, in whole or in part. When the domain is floating-point, the ceiling() function is omitted; and the number of significant digits preserved then depends on the quantization imposed by the RTI view (for example, a domain extending from 0.0 through 1.0 would have a maximum precision of about $1/2^{63} \sim 10^{-19}$).

Form unlinear (normalized, domainLower, domainUpper)

Parameters *normalized:* the federation's view of the *domain* value other parameters as per B.1

Function domainLower + ceiling([normalized * {domainUpper – domainLower}] / {DUB – 1})

B.2 Linear enumerated normalization function

Same problem as with B.1:

Function floor([positionInMappedSet(domain) / {mappedSetLength – 1}] * {DUB – 1})

Or:

Function [positionInMappedSet(domain) * (DUB – 1)] div (mappedSetLength – 1)

B.2.1 Linear enumerated unnormalization function

Here the `elementFromMappedSet(n)` function returns the zero-based nth element of the mapped set:

Form unlinear (normalized, mappedSet)

Parameters *normalized:* the federation's view of the *domain* value

other parameters as per B.2

Function elementFromMappedSet(ceiling(n*{mappedSetLength – 1} / {DUB – 1}))

B.3.1 Enumerated set unnormalization function

Whereas the normalization function's `RTIset` is best described by a Java `HashMap`, (which uses `mappedSet` for its keys), unnormalization won't be as efficient since the implementation will have to iterate over the values in order to retrieve any one key.

Function unRTIset(normalized)
where
unRTIset(normalized) is a function that maps the RTI's view to *mappedSet* values

B.4 Logarithmic normalization function

Same problem as with B.1:

Function floor([log(domain/domainLower) / log(domainUpper/domainLower) * {DUB – 1})

B.4.1 Logarithmic unnormalization function

Function ceiling(domainLower * exp(log(domainUpper/domainLower) * normalized / {DUB – 1}))

B.5 Hyperbolic tangent normalization function

Same problem as with B.1:

Function floor([{tanh([domain – domainCenter]/domainSize) + 1}/2] * {DUB – 1})

B.5.1 Hyperbolic tangent unnormalization function

Function ceiling(domainCentre + domainSize*arctanh([2*normalized/{DUB – 1}] – 1))

C.2 HLA OMT DIF DTD declaration

Interpretation 1

Replace (fourth paragraph, first bullet):

In the tabular representation of object models, object class and interaction class inheritance are represented by columns in which the parent of a class was represented to its left and children to its right. In the XML depiction of object models, inheritance is represented by membership, in which where children of a parent class are depicted as class elements contained within the parent class element.

With:

In the tabular representation of object models, object class and interaction class inheritance are represented by columns in which the parent of a class was represented to its left and children to its right. In the XML depiction of object models, inheritance is represented by membership, in which children of a parent class are depicted as class elements contained within the parent class element.

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Annex B – HLA 1516 Java API with Javadoc

The files that make up the Java API are listed in alphabetical order, except for the Exceptions which are grouped at the end of the annex.

```
// File: AttributeHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Type-safe handle for an attribute. Generally these are created by
the RTI and passed to the federate.
 * <p>
 * <code>AttributeHandle</code>s are obtained from the
 * (10.4) {@link RTIambassador#getAttributeHandle getAttributeHandle}
 * method and are used by a variety of other methods.
 * <p>
 * They can also be obtained by using the
<code>AttributeHandleFactory</code>'s {@link
AttributeHandleFactory#decode decode} method on a <code>byte[]</code>
 * received as part of an attribute update or interaction.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
AttributeHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>AttributeHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and
<code>otherAttributeHandle</code> represent the same attribute handle.
    * @param otherAttributeHandle the <code>Object</code> to compare
with
    * @return <code>true</code> iff supplied
<code>otherAttributeHandle</code> is of type
<code>AttributeHandle</code> and has same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherAttributeHandle);
   /**
    * Returns a hash code for <code>this</code>; two
<code>AttributeHandle</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode();

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>AttributeHandle</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end AttributeHandle
```

```
// File: AttributeHandleFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getAttributeHandleFactory getAttributeHandleFactory}
method.
 * Its one method creates a new {@link AttributeHandle} from a
supplied <code>byte[]</code> representation,
 * itself received as an attribute or parameter value.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
AttributeHandleFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link AttributeHandle} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of an <code>AttributeHandle</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>AttributeHandle</code> begins
    * @return An <code>AttributeHandle</code> constructed from the
buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public AttributeHandle
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode,
             FederateNotExecutionMember;
}
//end AttributeHandleFactory
```

```
// File: AttributeHandleSet.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * A Set of {@link AttributeHandle}s.
 * All {@link java.util.Set} operations are required, none are
optional.
 * <code>add()</code> and <code>remove()</code> should throw {@link
IllegalArgumentException} if
 * the argument is not an <code>AttributeHandle</code>.
 * <code>addAll()</code>, <code>removeAll()</code> and
<code>retainAll()</code> should throw {@link IllegalArgumentException}
if
 * the argument is not an <code>AttributeHandleSet</code>.
 * <p>
 * <code>AttributeHandleSet</code>s are used by numerous {@link
RTIambassador} methods and
 * are provided by numerous {@link FederateAmbassador} callbacks.
 * Empty ones can be created by the
<code>AttributeHandleSetFactory</code>'s
 * {@link AttributeHandleSetFactory#create create} method.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
AttributeHandleSet
   extends java.util.Set,
           java.lang.Cloneable,
           java.io.Serializable
{
}
//end AttributeHandleSet
```

```
// File: AttributeHandleSetFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getAttributeHandleSetFactory
getAttributeHandleSetFactory} method.
 * Its one method creates a new {@link AttributeHandleSet},
 * to be loaded up and then passed to various {@link RTIambassador}
methods.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
AttributeHandleSetFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link AttributeHandleSet}, initially empty.
    * @return An empty <code>AttributeHandleSet</code>
    */
   public AttributeHandleSet
   create();
}
//end AttributeHandleSetFactory
```

```
// File: AttributeHandleValueMap.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * A Map linking {@link AttributeHandle} keys with the corresponding
<code>byte[]</code> attribute values.
 * All {@link java.util.Map} operations are required, none are
optional. Null mappings are not allowed.
 * <code>put()</code>, <code>putAll()</code> and <code>remove()</code>
should throw {@link IllegalArgumentException} if
 * the key is not an <code>AttributeHandle</code> or the value a
<code>byte[]</code>.
 * <p>
 * Its main purpose is for attribute update transmission using the
(6.6) {@link RTIambassador#updateAttributeValues
updateAttributeValues} (both forms)
 * method. The updates are received through the (6.7) {@link
FederateAmbassador#reflectAttributeValues reflectAttributeValues} (all
forms)
 * callback.
 * <p>
 * Empty <code>AttributeHandleValueMap</code>s can also be created by
the {@link AttributeHandleValueMapFactory#create create} method.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
AttributeHandleValueMap
   extends java.util.Map,
           java.lang.Cloneable,
           java.io.Serializable
{
}
//end AttributeHandleValueMap
```

```
// File: AttributeHandleValueMapFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getAttributeHandleValueMapFactory
getAttributeHandleValueMapFactory} method.
 * Its one method creates a new {@link AttributeHandleValueMap},
 * to be loaded up and then passed to the (6.6) {@link
RTIambassador#updateAttributeValues updateAttributeValues} (both
forms)
 * method.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
AttributeHandleValueMapFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link AttributeHandleValueMap} with the specified
initial capacity.
    * @param capacity The initial size of the
<code>AttributeHandleValueMap</code>, in number of keys
    * @return An <code>AttributeHandleValueMap</code> of the specified
initial capacity (in keys)
    */
   public AttributeHandleValueMap
   create(int capacity);
}
//end AttributeHandleValueMapFactory
```

```
// File: AttributeRegionAssociation.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Record stored in {@link AttributeSetRegionSetPairList}.
 * Each record of that list associates a set of attributes with a set
of regions.
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 adds this class,
inadvertently omitted from Annex B of IEEE 1516.1-2000.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
AttributeRegionAssociation
    implements java.io.Serializable
{
   /**
    * The associated attribute set.
    */
   public
   AttributeHandleSet ahset;

   /**
    * The associated region set.
    */
   public
   RegionHandleSet rhset;

   /**
    * Constructs an AttributeRegionAssociation from the component
attribute and region sets.
    * @param ahs The {@link AttributeHandleSet} to associate with the
region set
    * @param rhs The {@link RegionHandleSet} to associate with the
attribute set
    */
   public
   AttributeRegionAssociation(AttributeHandleSet ahs,
                              RegionHandleSet    rhs)
   {
      ahset = ahs;
      rhset = rhs;
   }
}
//end AttributeRegionAssociation
```

```
// File: AttributeSetRegionSetPairList.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * This packages the attributes supplied to the RTI for various DDM
services with
 * the regions to be used with the attributes.
 * It is a {@link java.util.List} of {@link
AttributeRegionAssociation}s.
 * Each attribute appearing in an
<code>AttributeRegionAssociation.AttributeHandleSet</code> is
[un]associated with each
 * region appearing in the corresponding
<code>AttributeRegionAssociation.RegionHandleSet</code>.
 * <p>
 * All List operations are required, none are optional.
 * <code>add()</code>, <code>addAll()</code> and <code>set()</code>
should throw {@link IllegalArgumentException}
 * if the argument is not an <code>AttributeRegionAssociation</code>.
 * <p>
 * Used by the (9.5) {@link
RTIambassador#registerObjectInstanceWithRegions
registerObjectInstanceWithRegions} (both forms),
 * (9.6/9.7) {@link RTIambassador#unassociateRegionsForUpdates [un]}
{@link RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates},
 * (9.8/9.9) {@link
RTIambassador#unsubscribeObjectClassAttributesWithRegions [un]} {@link
RTIambassador#subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions} {@link
RTIambassador#subscribeObjectClassAttributesPassivelyWithRegions
[Passively]} or
 * (9.13) {@link RTIambassador#requestAttributeValueUpdateWithRegions
requestAttributeValueUpdateWithRegions}
 * methods.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see AttributeSetRegionSetPairListFactory
 */
public interface
AttributeSetRegionSetPairList
   extends java.util.List,
           java.lang.Cloneable,
           java.io.Serializable
{
}
//end AttributeSetRegionSetPairList
```

```
// File: AttributeSetRegionSetPairListFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getAttributeSetRegionSetPairListFactory
getAttributeSetRegionSetPairListFactory} method.
 * Its one method creates a new {@link AttributeSetRegionSetPairList},
 * to be loaded up and then passed to the (9.5) {@link
RTIambassador#registerObjectInstanceWithRegions
registerObjectInstanceWithRegions} (both forms),
 * (9.6/9.7) {@link RTIambassador#unassociateRegionsForUpdates [un]}
{@link RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates},
 * (9.8/9.9) {@link
RTIambassador#unsubscribeObjectClassAttributesWithRegions [un]} {@link
RTIambassador#subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions} {@link
RTIambassador#subscribeObjectClassAttributesPassivelyWithRegions
[Passively]} or
 * (9.13) {@link RTIambassador#requestAttributeValueUpdateWithRegions
requestAttributeValueUpdateWithRegions}
 * methods.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
AttributeSetRegionSetPairListFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link AttributeSetRegionSetPairList} with the
specified initial capacity.
    * @param capacity The initial size of the
<code>AttributeSetRegionSetPairList</code>, in number of
</code>AttributeSetRegionSetPair</code>s
    * @return An <code>AttributeSetRegionSetPairList</code> of the
specified initial capacity (in
</code>AttributeSetRegionSetPair</code>s)
    */
   public AttributeSetRegionSetPairList
   create(int capacity);
}
//end AttributeSetRegionSetPairListFactory
```

```
// File: DimensionHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Type-safe handle for a dimension. Generally these are created by
the RTI and passed to the federate.
 * <p>
 * <code>DimensionHandle</code>s can be obtained from the
 * (10.12) {@link RTIambassador#getDimensionHandle getDimensionHandle}
 * and (as parts of a {@link DimensionHandleSet}) the
 * (10.15) {@link
RTIambassador#getAvailableDimensionsForClassAttribute
getAvailableDimensionsForClassAttribute},
 * (10.17) {@link
RTIambassador#getAvailableDimensionsForInteractionClass
getAvailableDimensionsForInteractionClass} and
 * (10.30) {@link RTIambassador#getDimensionHandleSet
getDimensionHandleSet} methods.
 * <p>
 * They can also be obtained by using the
<code>DimensionHandleFactory</code>'s {@link
DimensionHandleFactory#decode decode} method on a <code>byte[]</code>
 * received as part of an attribute update or interaction.
 * <p>
 * <code>DimensionHandle</code>s are used to build a {@link
DimensionHandleSet} which can be passed to
 * the (9.2) {@link RTIambassador#createRegion createRegion} method.
 * They are also used by the
 * (10.13) {@link RTIambassador#getDimensionName getDimensionName},
 * (10.14) {@link RTIambassador#getDimensionUpperBound
getDimensionUpperBound},
 * (10.31/10.32) {@link RTIambassador#getRangeBounds get}/{@link
RTIambassador#setRangeBounds setRangeBounds} methods.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
DimensionHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>DimensionHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();
   /**
    * Returns true iff <code>this</code> and
<code>otherDimensionHandle</code> represent the same dimension handle.
    * @param otherDimensionHandle the <code>Object</code> to compare
with
    * @return <code>true</code> iff supplied
<code>otherDimensionHandle</code> is of type
<code>DimensionHandle</code> and has same value
    */
   public boolean
   equals(Object otherDimensionHandle);

   /**
    * Returns a hash code for <code>this</code>; two
<code>DimensionHandle</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>DimensionHandle</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset The offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer, int offset);
}
//end DimensionHandle
```

```
// File: DimensionHandleFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getDimensionHandleFactory getDimensionHandleFactory}
method.
 * Its one method creates a new {@link DimensionHandle} from a
supplied <code>byte[]</code> representation,
 * itself received as an attribute or parameter value.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
DimensionHandleFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link DimensionHandle} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of a <code>DimensionHandle</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>DimensionHandle</code> begins
    * @return A <code>DimensionHandle</code> constructed from the
buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public DimensionHandle
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode,
             FederateNotExecutionMember;
}
//end DimensionHandleFactory
```

```
// File: DimensionHandleSet.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * A {@link java.util.Set} of {@link DimensionHandle}s.
 * All Set operations are required, none are optional.
 * <code>add()</code> and <code>remove()</code> should throw {@link
IllegalArgumentException} if the argument is not a
<code>DimensionHandle</code>.
 * <code>addAll()</code>, <code>removeAll()</code> and
<code>retainAll()</code> should throw
<code>IllegalArgumentException</code> if
 * the argument is not a <code>DimensionHandleSet</code>.
 * <p>
 * Used with the (9.2) {@link RTIambassador#createRegion createRegion}
method.
 * Returned by the
 * (10.15) {@link
RTIambassador#getAvailableDimensionsForClassAttribute
getAvailableDimensionsForClassAttribute},
 * (10.17) {@link
RTIambassador#getAvailableDimensionsForInteractionClass
getAvailableDimensionsForInteractionClass} and
 * (10.30) {@link RTIambassador#getDimensionHandleSet
getDimensionHandleSet}
 * methods.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see DimensionHandleSetFactory
 */
public interface
DimensionHandleSet
   extends java.lang.Cloneable,
           java.io.Serializable,
           java.util.Set
{
}
//end DimensionHandleSet
```

```
// File: DimensionHandleSetFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getDimensionHandleSetFactory
getDimensionHandleSetFactory} method.
 * Its one method creates a new {@link DimensionHandleSet},
 * to be loaded up and then passed to the (9.2) {@link
RTIambassador#createRegion createRegion} method.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
DimensionHandleSetFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link DimensionHandleSet}, initially empty.
    * @return An empty <code>DimensionHandleSet</code>
    */
   public DimensionHandleSet
   create();
}
//end DimensionHandleSetFactory
```

```
// File: FederateAmbassador.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Federate must implement this interface.
 * <p>
 * As of DoD Interpretations of IEEE 1516-2000v2, none of the
<code>FederateAmbassador</code> callbacks will ever occur
 * with a <code>null</code> argument, with one exception: user-
supplied <code>tag</code> arguments may be <code>null</code>.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface FederateAmbassador
{
   ////////////////////////////////////
   // Federation Management Services //
   ////////////////////////////////////

   // 4.7
   /**
    * Notifies the federate that it has successfully registered a
federation synchronization point.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see #announceSynchronizationPoint announceSynchronizationPoint
    * @see #federationSynchronized federationSynchronized
    */
   public void
   synchronizationPointRegistrationSucceeded(
      String synchronizationPointLabel)
   throws FederateInternalError;
   /**
    * Notifies the federate that it has failed to register a
federation synchronization point.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @param reason a {@link SynchronizationPointFailureReason}
specifying what went wrong
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see #announceSynchronizationPoint announceSynchronizationPoint
    * @see #federationSynchronized federationSynchronized
    */
   public void
   synchronizationPointRegistrationFailed(
      String                            synchronizationPointLabel,
      SynchronizationPointFailureReason reason)
   throws FederateInternalError;
   // 4.8
   /**
    * Notifies the federate that a synchronization point exists.
    * Achievement of the point is signalled to the RTI through the
    * {@link RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved} method.
    * <p>
    * Federates are by default part of the synchronization set, unless
a {@link FederateHandleSet} has been specifically
    * supplied to the {@link
RTIambassador#registerFederationSynchronizationPoint(String,byte[],Fed
erateHandleSet)} method.
    * A federate that resigns is simply removed from the
synchronization set.
    * The synchronization point exists until it has been achieved by
all concerned federates, which could be
    * until the federation execution concludes.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see #synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see #federationSynchronized federationSynchronized
    */
   public void
   announceSynchronizationPoint(
      String synchronizationPointLabel,
      byte[] userSuppliedTag)
   throws FederateInternalError;
   // 4.10
   /**
    * Informs the joined federate that all members of the
synchronization set of the specified synchronization point
    * have invoked the {@link
RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved} method for that point.
    * The synchronization point ceases to exist once this callback has
been invoked on all concerned federates.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see #synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see #announceSynchronizationPoint announceSynchronizationPoint
    */
   public void
   federationSynchronized(
      String synchronizationPointLabel)
   throws FederateInternalError;
   // 4.12
   /**
    * Instructs the joined federate that it is now in the Instructed
To Save state
    * and should therefore save state as soon as possible.
    * The joined federate should use the supplied <code>label</code>,
    * the name of the federation execution (see the
<code>federationExecutionName</code>
    * of the {@link RTIambassador#joinFederationExecution
joinFederationExecution} invocation),
    * its joined federate designator (returned by the aforementioned
invocation) and
    * its federate type (the aforementioned invocation's
<code>federateType</code> argument)
    * to distinguish the saved state information.
    * <p>
    * A federate that is not time constrained should expect this
callback at any point.
    * A time constrained federate can receive this callback only
whilst in the Time Advancing state.
    * Once in the Instructed To Save state, the federate is severely
limited in which RTIambassador
    * methods it can invoke. This lasts through the Saving and Waiting
For Federation To Save states,
    * concluding with the {@link #federationSaved federationSaved} or
    * {@link #federationNotSaved federationNotSaved} callbacks.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws UnableToPerformSave should be thrown if the save
operation seems doomed
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   initiateFederateSave(
      String label)
   throws UnableToPerformSave,
          FederateInternalError;
   /**
    * Instructs the joined federate that it is now in the Instructed
To Save state
    * (as of the specified <code>time</code>) and should therefore
save state as soon as possible.
    * <p>
    * For details, see the {@link #initiateFederateSave(String)}
callback.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @param time a {@link LogicalTime} specifying when the save was
scheduled
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws UnableToPerformSave should be thrown if the save
operation seems doomed
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #federationSaved federationSaved
    * @see #federationNotSaved federationNotSaved
    * @see #federationSaveStatusResponse federationSaveStatusResponse
    */
   public void
   initiateFederateSave(
      String      label,
      LogicalTime time)
   throws InvalidLogicalTime,
          UnableToPerformSave,
          FederateInternalError;
   // 4.15
   /**
    * Informs the joined federate that the federation save process is
complete and successfull.
    * <p>
    * All joined federates at which the {@link #initiateFederateSave
initiateFederateSave} callback
    * was invoked have in turn invoked the {@link
RTIambassador#federateSaveComplete federateSaveComplete} method.
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #initiateFederateSave initiateFederateSave
    * @see #federationNotSaved federationNotSaved
    * @see #federationSaveStatusResponse federationSaveStatusResponse
    */
   public void
   federationSaved()
   throws FederateInternalError;
   /**
    * Informs the joined federate that the federation save process has
completed in failure.
    * <p>
    * The possible save failure reasons are:
    * <ul>
    * <li> RTI_UNABLE_TO_SAVE: The RTI was unable to save
    * <li> FEDERATE_REPORTED_FAILURE: One or more joined federates
have invoked the {@link RTIambassador#federateSaveNotComplete
federateSaveNotComplete} method
    * <li> FEDERATE_RESIGNED: One or more joined federates have
resigned from the federation execution
    * <li> RTI_DETECTED_FAILURE: The RTI has detected failure at one
or more of the joined federates
    * <li> SAVE_TIME_CANNOT_BE_HONORED: The time stamp specified by
the {@link RTIambassador#requestFederationSave(String,LogicalTime)}
    * request cannot be honoured, due to possible race conditions in
the distributed calculation of GALT (Greatest Available Logical Time)
    * </ul>
    * @param reason a {@link SaveFailureReason} specifying why the
save failed
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #initiateFederateSave initiateFederateSave
    * @see #federationSaved federationSaved
    * @see #federationSaveStatusResponse federationSaveStatusResponse
    */
   public void
   federationNotSaved(
      SaveFailureReason reason)
   throws FederateInternalError;
   // 4.17
   /**
    * Supplies the federate with the previously requested save status
indicators.
    * @param response a {@link FederateHandleSaveStatusPair}[]
specifying the {@link SaveStatus} of each federate
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #initiateFederateSave initiateFederateSave
    * @see #federationSaved federationSaved
    * @see #federationNotSaved federationNotSaved
    */
   public void
   federationSaveStatusResponse(
      FederateHandleSaveStatusPair[] response)
   throws FederateInternalError;
   // 4.19
   /**
    * Indicates that the federate's previous {@link
RTIambassador#requestFederationRestore requestFederationRestore} has
been granted.
    * <p>
    * This means the RTI has located the RTI-specific saved state
information matching the previously supplied
    * <code>label</code>, {@link RTIambassador#joinFederationExecution
federationExecutionName} and
    * {@link RTIambassador#createFederationExecution fdd}, and that
the census of currently joined
    * federates matches in number and {@link
RTIambassador#joinFederationExecution federateType} that of the
    * RTI's saved state.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   requestFederationRestoreSucceeded(
      String label)
   throws FederateInternalError;
   /**
    * Indicates that the federate's previous {@link
RTIambassador#requestFederationRestore requestFederationRestore} has
been denied.
    * <p>
    * This means the RTI failed to locate its specific saved state
information or that the census of
    * currently joined federates does not match in number and {@link
RTIambassador#joinFederationExecution federateType}
    * that of the retrieved RTI saved state.
    * Failures by individual federates to complete the restoration
process lead to the
    * {@link #federationNotRestored federationNotRestored} callback
instead.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   requestFederationRestoreFailed(
      String label)
   throws FederateInternalError;
   // 4.20
   /**
    * Instructs the joined federate that it is now in the Prepared To
Restore state
    * and should prepare to proceed with saved state restoration. The
necessary information
    * is later provided by the {@link #initiateFederateRestore
initiateFederateRestore} callback.
    * <p>
    * Once in the Prepared To Restore state, the federate is severely
limited in which RTIambassador
    * methods it can invoke. This lasts through the Restoring and
Waiting For Federation To Restore states,
    * concluding with the {@link #federationRestored
federationRestored} or
    * {@link #federationNotRestored federationNotRestored} callbacks.
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federationRestoreBegun()
   throws FederateInternalError;
   // 4.21
   /**
    * Instructs the joined federate to return to a previously saved
state.
    * The joined federate should use the supplied <code>label</code>,
    * the name of the federation execution (see the
<code>federationExecutionName</code>
    * of the {@link RTIambassador#joinFederationExecution
joinFederationExecution} invocation),
    * the supplied federate designator (<code>federateHandle</code>)
and
    * its federate type (the aforementioned invocation's
<code>federateType</code> argument)
    * to retrieve the saved state information.
    * <p>
    * Note that the supplied <code>federateHandle</code> may differ
from the federate's current {@link FederateHandle};
    * it will assume this new designator if and once it receives the
{@link #federationRestored federationRestored} callback.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @param federateHandle the {@link FederateHandle} that the
federate will assume if and once it receives the {@link
#federationRestored federationRestored} callback
    * @throws SpecifiedSaveLabelDoesNotExist should be thrown if the
label isn't recognized
    * @throws CouldNotInitiateRestore should be thrown if the federate
is unwilling or unable to initiate the restore operation
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   initiateFederateRestore(
      String         label,
      FederateHandle federateHandle)
   throws SpecifiedSaveLabelDoesNotExist,
          CouldNotInitiateRestore,
          FederateInternalError;
   // 4.23
   /**
    * Informs the joined federate that the federation restore process
is complete and successfull.
    * This means that all joined federates which received the {@link
#federationRestoreBegun federationRestoreBegun}
    * callback have invoked the {@link
RTIambassador#federateRestoreComplete federateRestoreComplete} method.
    * The federate's {@link FederateHandle} is now the one that was
supplied by the {@link #initiateFederateRestore
initiateFederateRestore} callback.
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federationRestored()
   throws FederateInternalError;
   /**
    * Informs the joined federate that the federation restore process
has completed in failure.
    * <p>
    * The possible save failure reasons are:
    * <ul>
    * <li> RTI_UNABLE_TO_RESTORE: The RTI was unable to restore
    * <li> FEDERATE_REPORTED_FAILURE: One or more federates have
invoked the {@link RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete} method
    * <li> FEDERATE_RESIGNED: One or more joined federates have
resigned from the federation execution
    * <li> RTI_DETECTED_FAILURE: The RTI has detected failure at one
or more of the joined federates
    * </ul>
    * @param reason a {@link RestoreFailureReason} specifying the
reason for the failure
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federationNotRestored(
      RestoreFailureReason reason)
   throws FederateInternalError;
   // 4.25
   /**
    * Supplies the federate with the previously requested restore
status indicators.
    * <p>
    * The {@link FederateHandle}s used in the {@link
FederateHandleRestoreStatusPair}[] are the pre-restore ones
    * until all federates have invoked the {@link
RTIambassador#federateRestoreComplete federateRestoreComplete}
    * service. Once all federates have been issued the {@link
#federationRestored} callbacks, the post-restore
    * <code>FederateHandle</code>s are used (and each federate's
status will be {@link RestoreStatus NO_RESTORE_IN_PROGRESS}).
    * <p>
    * If the {@link RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus} service is
    * invoked between those two times, the {@link RestoreStatus} and
<code>FederateHandle</code>s are unpredictable.
    * A federate should therefore avoid invoking the
<code>queryFederationRestoreStatus</code> service between the moment
    * it invokes the <code>federateRestoreComplete</code> service and
the moment it receives the <code>federationRestored</code>
    * or {@link #federationNotRestored} callbacks.
    * @param response a {@link FederateHandleRestoreStatusPair}[]
specifying the {@link RestoreStatus} of each federate
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    */
   public void
   federationRestoreStatusResponse(
      FederateHandleRestoreStatusPair[] response)
   throws FederateInternalError;
   /////////////////////////////////////
   // Declaration Management Services //
   /////////////////////////////////////

   // 5.10
   /**
    * Notifies the federate that registration of new object instances
of the specified object class
    * is advised because at least one of the federate-published class
attributes is actively subscribed to
    * by at least one other federate at that object class.
    * This occurs only if the federate's Object Class Relevance
Advisory Switch is turned on.
    * @param theClass the {@link ObjectClassHandle} of the subject
object class
    * @throws ObjectClassNotPublished should be thrown if the federate
denies publishing <code>theClass</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #stopRegistrationForObjectClass
stopRegistrationForObjectClass
    * @see RTIambassador#enableObjectClassRelevanceAdvisorySwitch
enableObjectClassRelevanceAdvisorySwitch
    * @see RTIambassador#disableObjectClassRelevanceAdvisorySwitch
disableObjectClassRelevanceAdvisorySwitch
    */
   public void
   startRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError;
   // 5.11
   /**
    * Notifies the federate that registration of new object instances
of the specified object class
    * is not advised because there are no active subscribers to any of
the federate-published class attributes
    * at that object class.
    * This occurs only if the federate's Object Class Relevance
Advisory Switch is turned on.
    * @param theClass the {@link ObjectClassHandle} of the subject
object class
    * @throws ObjectClassNotPublished should be thrown if the federate
denies publishing <code>theClass</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see RTIambassador#enableObjectClassRelevanceAdvisorySwitch
enableObjectClassRelevanceAdvisorySwitch
    * @see RTIambassador#disableObjectClassRelevanceAdvisorySwitch
disableObjectClassRelevanceAdvisorySwitch
    */
   public void
   stopRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError;

   // 5.12
   /**
    * Notifies the federate that the specified class of interactions
is relevant because
    * there is at least one active subscription by another federate.
    * This occurs only if the federate's Interaction Relevance
Advisory Switch is turned on.
    * @param theHandle the {@link InteractionClassHandle} of the
subject interaction class
    * @throws InteractionClassNotPublished should be thrown if the
federate denies publishing <code>theHandle</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnInteractionsOff turnInteractionsOff
    * @see RTIambassador#enableInteractionRelevanceAdvisorySwitch
enableInteractionRelevanceAdvisorySwitch
    * @see RTIambassador#disableInteractionRelevanceAdvisorySwitch
disableInteractionRelevanceAdvisorySwitch
    */
   public void
   turnInteractionsOn(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError;
   // 5.13
   /**
    * Notifies the federate that the specified class of interactions
is not relevant because
    * there are no active subscriptions by other federates.
    * This occurs only if the federate's Interaction Relevance
Advisory Switch is turned on.
    * @param theHandle the {@link InteractionClassHandle} of the
subject interaction class
    * @throws InteractionClassNotPublished should be thrown if the
federate denies publishing <code>theHandle</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnInteractionsOn turnInteractionsOn
    * @see RTIambassador#enableInteractionRelevanceAdvisorySwitch
enableInteractionRelevanceAdvisorySwitch
    * @see RTIambassador#disableInteractionRelevanceAdvisorySwitch
disableInteractionRelevanceAdvisorySwitch
    */
   public void
   turnInteractionsOff(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError;

   ////////////////////////////////
   // Object Management Services //
   ////////////////////////////////

   // 6.3
   /**
    * Notifies the federate that the <code>objectName</code> provided
in a previous invocation of the
    * {@link RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName} method has been reserved.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 changes the service name
from "<code>objectInstanceNameReservationSucceded</code>"
    * to "<code>objectInstanceNameReservationSucceeded</code>".
    * @param objectName a {@link java.lang.String} holding the
requested object name
    * @throws UnknownName should be thrown if the federate denies
requesting to reserve the <code>objectName</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName
    * @see #objectInstanceNameReservationFailed
objectInstanceNameReservationFailed
    */
   public void
   objectInstanceNameReservationSucceeded(
      String objectName)
   throws UnknownName,
          FederateInternalError;
   /**
    * Notifies the federate that the <code>objectName</code> provided
in a previous invocation of the
    * {@link RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName} method could not be reserved.
    * @param objectName a {@link java.lang.String} holding the
requested object name
    * @throws UnknownName should be thrown if the federate denies
requesting to reserve the <code>objectName</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName
    * @see #objectInstanceNameReservationSucceeded
objectInstanceNameReservationSucceeded
    */
   public void
   objectInstanceNameReservationFailed(
      String objectName)
   throws UnknownName,
          FederateInternalError;

   // 6.5
   /**
    * Notifies the federate that it has discovered an object instance.
    * @param theObject the {@link ObjectInstanceHandle} of the newly
discovered object instance
    * @param theObjectClass the {@link ObjectClassHandle} of the class
the instance was discovered as
    * @param objectName a {@link java.lang.String} holding the newly
discovered object instance's name
    * @throws CouldNotDiscover should be thrown if the object instance
could not be discovered for some reason other than an unrecognized
object class
    * @throws ObjectClassNotRecognized should be thrown if the
federate does not recognize <code>theObjectClass</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#registerObjectInstance registerObjectInstance
    */
   public void
   discoverObjectInstance(
      ObjectInstanceHandle theObject,
      ObjectClassHandle    theObjectClass,
      String               objectName)
   throws CouldNotDiscover,
          ObjectClassNotRecognized,
          FederateInternalError;
   // 6.7
   /**
    * Provides the federate with new values for the specified instance
attributes.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[])
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes
    * and specifies the update regions used.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided,
    * the instance attributes have available dimensions, the
federate's Convey Region
    * Designator Sets Switch is enabled and an update region set was
used by the sender.
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link InvalidRegion} or
{@link InvalidRegionContext}
    * exceptions (nor a notional new <code>InvalidRegionSet</code>
exception); in other words the RTI
    * guarantees the validity and pertinence of the supplied
<code>sentOrdering</code>,
    * <code>theTransport</code> and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param sentRegions the {@link RegionHandleSet} used to send the
update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[])
    * @see RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes
    * and specifies the time-stamp at which this comes into effect.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * a time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the <code>receivedOrdering</code> is also
RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link InvalidLogicalTime}
    * exceptions; in other words the RTI guarantees the validity of
the supplied
    * <code>sentOrdering</code>, <code>theTransport</code>,
<code>theTime</code>
    * and <code>receivedOrdering</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
    /**
     * Provides the federate with new values for the specified instance
attributes,
     * specifies the update regions used
     * and specifies the time-stamp at which this comes into effect.
     * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
     * forms the primary data exchange mechanism supported by the RTI.
     * This form is invoked by the RTI only if the sent order type was
RECEIVE,
     * a time-stamp was provided,
     * the instance attributes have available dimensions, the
federate's
     * Convey Region Designator Sets Switch is enabled and an update
region set
     * was used by the sender.
     * <p>
     * Note that the
     * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
     * (and that therefore the <code>receivedOrdering</code> is also
RECEIVE).
     * <p>
     * Note that the federate is not expected to throw the {@link
InvalidOrderType},
     * {@link InvalidTransportationType}, {@link InvalidLogicalTime},
{@link InvalidRegion} or
     * {@link InvalidRegionContext} exceptions (nor a notional new
<code>InvalidRegionSet</code>
     * exception); in other words the RTI guarantees the validity of
the supplied
     * <code>sentOrdering</code>, <code>theTransport</code>,
<code>theTime</code>,
     * <code>receivedOrdering</code> and <code>sentRegions</code>.
     * <p>
     * The time stamp and receive message order type arguments are
supplied together or not at all,
     * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param sentRegions the {@link RegionHandleSet} used to send the
update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    * @see RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes
    * and specifies the time-stamp at which this comes into effect as
well as a retraction handle.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (thus a time-stamp was provided)
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link
InvalidMessageRetractionHandle} exceptions;
    * in other words the RTI guarantees the validity of the supplied
    * <code>sentOrdering</code>, <code>theTransport</code>,
<code>receivedOrdering</code> and
    * <code>retractionHandle</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes,
    * specifies the update regions used
    * and specifies the time-stamp at which this comes into effect as
well as a retraction handle.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (thus a time-stamp was provided),
    * the instance attributes have available dimensions, the
federate's Convey Region Designator Sets Switch
    * is enabled and an update region set was used by the sender.
    * <p>
    * Note that the
    * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link
InvalidMessageRetractionHandle},
    * {@link InvalidRegion} or {@link InvalidRegionContext} exceptions
(nor a notional
    * new <code>InvalidRegionSet</code> exception); in other words the
RTI guarantees the validity
    * of the supplied <code>sentOrdering</code>,
<code>theTransport</code>, <code>receivedOrdering</code>,
    * <code>retractionHandle</code> and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @param sentRegions the {@link RegionHandleSet} used to send the
update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    * @see RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
   // 6.9
   /**
    * Provides the federate with a sent interaction.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleVa
lueMap,byte[])
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction and
    * specifies the broadcasting regions used.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided,
    * the parameters have available dimensions, the federate's Convey
Region
    * Designator Sets Switch is enabled and an update region set was
used by the sender.
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link InvalidRegion} or
{@link InvalidRegionContext} exceptions
    * (nor a notional new <code>InvalidRegionSet</code> exception); in
other words the RTI guarantees
    * the validity of the supplied <code>sentOrdering</code>,
<code>theTransport</code>
    * and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param sentRegions the {@link RegionHandleSet} used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteractionWithRegions(InteractionClassHandle,Parame
terHandleValueMap,RegionHandleSet,byte[])
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction
    * and specifies the time-stamp at which this occurs.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * a time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link InvalidLogicalTime}
exceptions; in other words the
    * RTI guarantees the validity of the supplied
<code>sentOrdering</code>, <code>theTransport</code>,
    * <code>receivedOrdering</code> and <code>theTime</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleVa
lueMap,byte[],LogicalTime)
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
    /**
     * Provides the federate with a sent interaction,
     * specifies the broadcasting regions used
     * and specifies the time-stamp at which this occurs.
     * This form is invoked by the RTI only if the sent order type was
RECEIVE,
     * a time-stamp was provided,
     * the parameters have available dimensions, the federate's Convey
Region
     * Designator Sets Switch is enabled and an update region set was
used by the sender.
     * <p>
     * Note that the
     * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
     * (and that therefore the received ordering is also RECEIVE).
     * <p>
     * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
     * {@link InvalidTransportationType} exceptions; in other words the
RTI
     * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
     * Note that the federate is not expected to throw the {@link
InvalidOrderType},
     * {@link InvalidTransportationType}, {@link InvalidLogicalTime},
{@link InvalidRegion} or
     * {@link InvalidRegionContext} exceptions (nor a notional new
<code>InvalidRegionSet</code> exception);
     * in other words the RTI guarantees the validity of the supplied
<code>sentOrdering</code>,
     * <code>theTransport</code>, <code>receivedOrdering</code>,
<code>theTime</code>
     * and <code>sentRegions</code>.
     * <p>
     * The time stamp and receive message order type arguments are
supplied together or not at all,
     * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param sentRegions the {@link RegionHandleSet} used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteractionWithRegions(InteractionClassHandle,Parame
terHandleValueMap,RegionHandleSet,byte[],LogicalTime)
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction
    * and specifies the time-stamp at which this occurs as well as a
retraction handle.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (thus a time-stamp was provided)
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link
InvalidMessageRetractionHandle} exceptions;
    * in other words the RTI guarantees the validity of the supplied
<code>sentOrdering</code>,
    * <code>theTransport</code>, <code>receivedOrdering</code> and
<code>messageRetractionHandle</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param messageRetractionHandle the {@link
MessageRetractionHandle} of the message
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleVa
lueMap,byte[],LogicalTime)
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction,
    * specifies the broadcasting regions used
    * and specifies the time-stamp at which this occurs as well as a
retraction handle.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (thus a time-stamp was provided),
    * the parameters have available dimensions, the federate's Convey
Region
    * Designator Sets Switch is enabled and an update region set was
used by the sender.
    * <p>
    * Note that the
    * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link
InvalidMessageRetractionHandle},
    * {@link InvalidRegion} or {@link InvalidRegionContext} exceptions
(nor a notional
    * new <code>InvalidRegionSet</code> exception); in other words the
RTI guarantees the validity
    * of the supplied <code>sentOrdering</code>,
<code>theTransport</code>, <code>receivedOrdering</code>,
    * <code>messageRetractionHandle</code> and
<code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param messageRetractionHandle the {@link
MessageRetractionHandle} of the message
    * @param sentRegions the {@link RegionHandleSet} used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#sendInteractionWithRegions
sendInteractionWithRegions
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
   // 6.11
   /**
    * Notifies the federate that an object instance has been deleted
from the federation execution.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE
    * and no time-stamp was provided.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the message was sent
as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#deleteObjectInstance deleteObjectInstance
    */
   public void
   removeObjectInstance(
      ObjectInstanceHandle theObject,
      byte[]               userSuppliedTag,
      OrderType            sentOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError;
   /**
    * Notifies the federate that an object instance has been deleted
from the federation execution
    * at the specified time stamp.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE
    * and a time-stamp was provided.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the message was sent
as
    * @param theTime the {@link LogicalTime} at which the deletion
occurs
    * @param receivedOrdering the {@link OrderType} the message was
received as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#deleteObjectInstance deleteObjectInstance
    */
   public void
   removeObjectInstance(
   ObjectInstanceHandle theObject,
      byte[]            userSuppliedTag,
      OrderType         sentOrdering,
      LogicalTime       theTime,
      OrderType         receivedOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError;
   /**
    * Notifies the federate that an object instance has been deleted
from the federation execution
    * at the specified time stamp and specifies a retraction handle.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (and thus a time-stamp was provided).
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the message was sent
as
    * @param theTime the {@link LogicalTime} at which the deletion
occurs
    * @param receivedOrdering the {@link OrderType} the message was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#deleteObjectInstance deleteObjectInstance
    */
   public void
   removeObjectInstance(
      ObjectInstanceHandle    theObject,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          InvalidLogicalTime,
          FederateInternalError;
   // 6.15
   /**
    * Notifies the federate that the specified attributes for the
object instance are in its scope.
    * This occurs only if the Attribute Scope Advisory Switch is on
for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the pertinent attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #attributesOutOfScope attributesOutOfScope
    * @see RTIambassador#enableAttributeScopeAdvisorySwitch
enableAttributeScopeAdvisorySwitch
    * @see RTIambassador#disableAttributeScopeAdvisorySwitch
disableAttributeScopeAdvisorySwitch
    */
   public void
   attributesInScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   // 6.16
   /**
    * Notifies the federate that the specified attributes for the
object instance are out of its scope.
    * This occurs only if the Attribute Scope Advisory Switch is on
for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the pertinent attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #attributesInScope attributesInScope
    * @see RTIambassador#enableAttributeScopeAdvisorySwitch
enableAttributeScopeAdvisorySwitch
    * @see RTIambassador#disableAttributeScopeAdvisorySwitch
disableAttributeScopeAdvisorySwitch
    */
   public void
   attributesOutOfScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   // 6.18
   /**
    * Requests of the federate the current values of the specified
instance attributes, which it owns.
    * The federate should respond through the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method.
    * @param theObject the {@link ObjectInstanceHandle} of the subject
object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the requested attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#requestAttributeValueUpdate
requestAttributeValueUpdate
    */
   public void
   provideAttributeValueUpdate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
   // 6.19
   /**
    * Indicates to the federate that the values of the specified
instance attributes are required somewhere
    * in the federation execution. The federate should therefore
update them as needed.
    * This occurs only if the Attribute Relevance Advisory Switch is
on for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the subject
object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnUpdatesOffForObjectInstance
turnUpdatesOffForObjectInstance
    * @see RTIambassador#enableAttributeRelevanceAdvisorySwitch
enableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#disableAttributeRelevanceAdvisorySwitch
disableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#updateAttributeValues updateAttributeValues
    */
   public void
   turnUpdatesOnForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
   // 6.20
   /**
    * Indicates to the federate that the values of the specified
instance attributes are no
    * longer required anywhere in the federation execution.
    * This occurs only if the Attribute Relevance Advisory Switch is
on for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the subject
object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnUpdatesOnForObjectInstance
turnUpdatesOnForObjectInstance
    * @see RTIambassador#enableAttributeRelevanceAdvisorySwitch
enableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#disableAttributeRelevanceAdvisorySwitch
disableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#updateAttributeValues updateAttributeValues
    */
   public void
   turnUpdatesOffForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
   ///////////////////////////////////
   // Ownership Management Services //
   ///////////////////////////////////

   // 7.4
   /**
    * Requests that the federate acquire ownership of the specified
instance attributes.
    * This can occur because the original owner invoked {@link
RTIambassador#unconditionalAttributeOwnershipDivestiture
unconditionalAttributeOwnershipDivestiture}
    * or {@link RTIambassador#resignFederationExecution
resignFederationExecution} (with the
    * UNCONDITIONALLY_DIVEST_ATTRIBUTES, DELETE_OBJECTS_THEN_DIVEST or
CANCEL_THEN_DELETE_THEN_DIVEST policy).
    * It will <i>not</i> occur if the original owner invoked the
{@link RTIambassador#unpublishObjectClassAttributes
unpublishObjectClassAttributes}
    * service or if the {@link RTIambassador#registerObjectInstance
registerObjectInstance} service is used (and
    * the newly-registered object instance has some unowned
attributes).
    * <p>
    * The federate may return a subset of the
<code>offeredAttributes</code> for which it is willing to assume
ownership
    * through the {@link RTIambassador#attributeOwnershipAcquisition
attributeOwnershipAcquisition} or {@link
RTIambassador#attributeOwnershipAcquisitionIfAvailable
attributeOwnershipAcquisitionIfAvailable} methods.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param offeredAttributes an {@link AttributeHandleSet}
specifying the offered attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeNotPublished should be thrown if the federate
denies publishing an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   requestAttributeOwnershipAssumption(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError;
   // 7.5
   /**
    * Notifies the federate that potential new owners have been found
for the specified instance attributes and that
    * the negotiated divestiture of these can now be completed. The
federate can either complete the negotiated
    * divestiture using {@link RTIambassador#confirmDivestiture
confirmDivestiture}, divest ownership of the instance attributes by
    * some other means (e.g., using {@link
RTIambassador#unconditionalAttributeOwnershipDivestiture
unconditionalAttributeOwnershipDivestiture}) or it can
    * {@link
RTIambassador#cancelNegotiatedAttributeOwnershipDivestiture
cancelNegotiatedAttributeOwnershipDivestiture}.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param offeredAttributes an {@link AttributeHandleSet}
specifying the offered attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws AttributeDivestitureWasNotRequested should be thrown if
the federate repudiates the divestiture
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   requestDivestitureConfirmation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          AttributeDivestitureWasNotRequested,
          FederateInternalError;
   // 7.7
   /**
    * Notifies the federate that it now owns the specified set of
instance attributes.
    * The federate may receive multiple notifications for a single
invocation of
    * {@link RTIambassador#attributeOwnershipAcquisition
attributeOwnershipAcquisition} or
    * {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable
attributeOwnershipAcquisitionIfAvailable} if the requested
    * instance attributes are owned by different federates.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param securedAttributes an {@link AttributeHandleSet}
specifying the secured attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAcquisitionWasNotRequested should be thrown if
the federate repudiates its attribute ownership acquisition request
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeNotPublished should be thrown if the federate
denies publishing an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   attributeOwnershipAcquisitionNotification(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   securedAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAcquisitionWasNotRequested,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError;
   // 7.10
   /**
    * Notifies the federate that the specified instance attributes
were not available for ownership acquisition.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the declined attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeAcquisitionWasNotRequested should be thrown if
the federate repudiates its attribute ownership acquisition request
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#attributeOwnershipAcquisitionIfAvailable
attributeOwnershipAcquisitionIfAvailable
    */
   public void
   attributeOwnershipUnavailable(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotRequested,
          FederateInternalError;
   // 7.11
   /**
    * Requests that the federate release ownership of the specified
instance attributes.
    * The federate may return the subset of instance attributes for
which it is willing
    * to release ownership through {@link
RTIambassador#attributeOwnershipDivestitureIfWanted
attributeOwnershipDivestitureIfWanted},
    * {@link RTIambassador#unconditionalAttributeOwnershipDivestiture
unconditionalAttributeOwnershipDivestiture} or
    * {@link RTIambassador#negotiatedAttributeOwnershipDivestiture
negotiatedAttributeOwnershipDivestiture}.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param candidateAttributes an {@link AttributeHandleSet}
specifying the candidate attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#attributeOwnershipAcquisition
attributeOwnershipAcquisition
    */
   public void
   requestAttributeOwnershipRelease(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   candidateAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
   // 7.15
   /**
    * Notifies the federate that the pending attribute ownership
acquisition requests for the
    * specified instance attributes have been canceled as requested.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeAcquisitionWasNotCanceled should be thrown if
the federate repudiates the attribute ownership acquisition
cancellation
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#cancelAttributeOwnershipAcquisition
cancelAttributeOwnershipAcquisition
    */
   public void
   confirmAttributeOwnershipAcquisitionCancellation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotCanceled,
          FederateInternalError;
   // 7.17
   /**
    * In response to an attribute ownership query by the federate,
specifies the instance attribute's owner: another federate.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttribute an {@link AttributeHandle} specifying the
attribute
    * @param theOwner the {@link FederateHandle} of the federate
owning the attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#queryAttributeOwnership
queryAttributeOwnership
    */
   public void
   informAttributeOwnership(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute,
      FederateHandle       theOwner)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;

   /**
    * In response to an attribute ownership query by the federate,
specifies that the instance attribute is unowned.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttribute an {@link AttributeHandle} specifying the
attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#queryAttributeOwnership
queryAttributeOwnership
    */
   public void
   attributeIsNotOwned(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;
   /**
    * In response to an attribute ownership query by the federate,
specifies the instance attribute's owner: the RTI.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttribute an {@link AttributeHandle} specifying the
attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#queryAttributeOwnership
queryAttributeOwnership
    */
   public void
   attributeIsOwnedByRTI(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;

   //////////////////////////////
   // Time Management Services //
   //////////////////////////////

   // 8.3
   /**
    * Notifies the federate that its request to enable time-regulation
has been honored.
    * @param time the {@link LogicalTime} to which the federate's
clock has been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws NoRequestToEnableTimeRegulationWasPending should be
thrown if the federate repudiates the time regulation request
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#enableTimeRegulation enableTimeRegulation
    */
   public void
   timeRegulationEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeRegulationWasPending,
          FederateInternalError;
   // 8.6
   /**
    * Notifies the federate that its request to enable time-constraint
has been honored.
    * @param time the {@link LogicalTime} to which the federate's
clock has been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws NoRequestToEnableTimeConstrainedWasPending should be
thrown if the federate repudiates the time constraint request
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#enableTimeConstrained enableTimeConstrained
    */
   public void
   timeConstrainedEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeConstrainedWasPending,
          FederateInternalError;

   // 8.13
   /**
    * Notifies the federate that its request to advance its logical
time has been honored.
    * @param theTime the {@link LogicalTime} to which the federate's
clock has been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws JoinedFederateIsNotInTimeAdvancingState should be thrown
if the federate does not consider itself in the time-advancing state
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#timeAdvanceRequest timeAdvanceRequest
    * @see RTIambassador#timeAdvanceRequestAvailable
timeAdvanceRequestAvailable
    * @see RTIambassador#nextMessageRequest nextMessageRequest
    * @see RTIambassador#nextMessageRequestAvailable
nextMessageRequestAvailable
    * @see RTIambassador#flushQueueRequest flushQueueRequest
    */
   public void
   timeAdvanceGrant(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          JoinedFederateIsNotInTimeAdvancingState,
          FederateInternalError;
   // 8.22
   /**
    * Notifies the federate that the previously delivered message
specified by the supplied
    * {@link MessageRetractionHandle} has been retracted.
    * <p>
    * Time-constrained federates that do not use the {@link
RTIambassador#flushQueueRequest flushQueueRequest} method
    * are not subject to invocation of this service because they will
never receive a
    * {@link OrderType TIMESTAMP} message eligible for retraction.
    * Non-constrained federates, however, must be prepared to deal
with invocations of this
    * service because any received message that was sent {@link
OrderType TIMESTAMP} may be eligible for retraction.
    * @param theHandle the {@link MessageRetractionHandle} specifying
the retracted message
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#retract retract
    */
   public void
   requestRetraction(
      MessageRetractionHandle theHandle)
   throws FederateInternalError;
}
//end FederateAmbassador
```

```
// File: FederateHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Type-safe handle for a federate handle. Generally these are created
by the RTI and passed to the federate.
 * <p>
 * The federate obtains its own <code>FederateHandle</code> from the
(4.4) {@link RTIambassador#joinFederationExecution
joinFederationExecution}
 * and (4.21) {@link FederateAmbassador#initiateFederateRestore
initiateFederateRestore} methods; other federates'
<code>FederateHandle</code>s are received through
 * the (4.17) {@link FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse} (as part of a {@link
FederateHandleSaveStatusPair}[]),
 * (4.25) {@link FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse} (as part of a {@link
FederateHandleRestoreStatusPair}[]) and
 * (7.17) {@link FederateAmbassador#informAttributeOwnership
informAttributeOwnership} callbacks.
 * <p>
 * They can also be obtained by using the
<code>FederateHandleFactory</code>'s {@link
FederateHandleFactory#decode decode} method on a <code>byte[]</code>
 * received as part of an attribute update or interaction.
 * The Management Object Model (MOM) publishes the
<code>HLAmanager.HLAfederate</code> object class, which has a
<code>HLAfederateHandle</code> attribute.
 * The MOM also publishes the <code>HLAmanager.HLAfederate</code>
interaction class (and its numerous sub-classes), which has a
<code>HLAfederate</code> parameter.
 * The aforementioned attribute and parameter both have values of type
<code>FederateHandle</code> (known to the MOM as
<code>HLAhandle</code>).
 * <p>
 * <code>FederateHandle</code>s are used to build a {@link
FederateHandleSet} which can be passed to
 * the (4.6) {@link
RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint} method.
 * Lastly, the (10.33) {@link RTIambassador#normalizeFederateHandle
normalizeFederateHandle}
 * method can be used to project a <code>FederateHandle</code> onto
the <code>Federates</code>
 * dimension for <code>Region</code> specification purposes.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
```

```
public interface
FederateHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>FederateHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and
<code>otherFederateHandle</code> represent the same federate handle.
    * @param otherFederateHandle the <code>Object</code> to compare
with
    * @return <code>true</code> iff supplied
<code>otherFederateHandle</code> is of type
<code>FederateHandle</code> and has same value
    */
   public boolean
   equals(Object otherFederateHandle);

   /**
    * Returns a hash code for <code>this</code>; two
<code>FederateHandle</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>FederateHandle</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end FederateHandle
```

```
// File: FederateHandleFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getFederateHandleFactory getFederateHandleFactory}
method.
 * Its one method creates a new {@link FederateHandle} from a supplied
<code>byte[]</code> representation,
 * itself received as an attribute or parameter value.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
FederateHandleFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link FederateHandle} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of a <code>FederateHandle</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>FederateHandle</code> begins
    * @return A <code>FederateHandle</code> constructed from the
buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public FederateHandle
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode,
             FederateNotExecutionMember;
}
//end FederateHandleFactory
```

```
// File: FederateHandleRestoreStatusPair.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * The (4.25) {@link
FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse}
 * callback returns an array of these records. For each joined
federate, there will
 * be a <code>FederateHandleRestoreStatusPair</code> record returned,
specifying the
 * {@link RestoreStatus} of each {@link FederateHandle}.
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 adds the
java.io.Serializable implementation and a constructor.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see hla.rti1516.RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
 */
public final class
FederateHandleRestoreStatusPair
    implements java.io.Serializable
{
   /**
    * The federate handle.
    */
   public
   FederateHandle handle;

   /**
    * The federate's restoration status.
    */
   public RestoreStatus  status;

   /**
    * Public constructor. Not expected to be used by the federate but
rather by the RTI.
    * @param fh The <code>FederateHandle</code> of the federate whose
corresponding <code>RestoreStatus</code> is specified by this record
    * @param rs The <code>RestoreStatus</code> of the federate
specified by the <code>FederateHandle</code> field of this record
    */
   public
   FederateHandleRestoreStatusPair(FederateHandle fh,
                                   RestoreStatus  rs)
   {
      handle = fh;
      status = rs;
   }
}
//end FederateHandleRestoreStatusPair
```

```
// File: FederateHandleSaveStatusPair.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * The (4.17) {@link FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse}
 * callback returns an array of these records. For each joined
federate, there will
 * be a <code>FederateHandleSaveStatusPair</code> record returned,
specifying the
 * {@link SaveStatus} of each {@link FederateHandle}.
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 adds the
java.io.Serializable implementation and a constructor.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see hla.rti1516.RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
 */
public final class
FederateHandleSaveStatusPair
   implements java.io.Serializable
{
   /**
    * The federate handle.
    */
   public
   FederateHandle handle;

   /**
    * The federate's save status.
    */
   public
   SaveStatus status;

   /**
    * Public constructor. Not expected to be used by the federate but
rather by the RTI.
    * @param fh The <code>FederateHandle</code> of the federate whose
corresponding <code>SaveStatus</code> is specified by this record
    * @param ss The <code>SaveStatus</code> of the federate specified
by the <code>FederateHandle</code> field of this record
    */
   public
   FederateHandleSaveStatusPair(FederateHandle fh,
                                SaveStatus     ss)
   {
      handle = fh;
      status = ss;
   }
}
//end FederateHandleSaveStatusPair
```

```
// File: FederateHandleSet.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * A Set of {@link FederateHandle}s.
 * All {@link java.util.Set} operations are required, none are
optional.
 * <code>add()</code> and <code>remove()</code> should throw {@link
IllegalArgumentException} if the argument is not a
<code>FederateHandle</code>.
 * <code>addAll()</code>, <code>removeAll()</code> and
<code>retainAll()</code> should throw
<code>IllegalArgumentException</code> if
 * the argument is not a <code>FederateHandleSet</code>.
 * <p>
 * Used with the (4.6) {@link
RTIambassador#registerFederationSynchronizationPoint(String,byte[],Fed
erateHandleSet)}
 * method.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see FederateHandleSetFactory
 */
public interface
FederateHandleSet
   extends java.io.Serializable,
           java.lang.Cloneable,
           java.util.Set
{
}
//end FederateHandleSet
```

```
// File: FederateHandleSetFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getFederateHandleSetFactory getFederateHandleSetFactory}
method.
 * Its one method creates a new {@link FederateHandleSet},
 * to be loaded up and then passed to the (4.6) {@link
RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint} method.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
FederateHandleSetFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link FederateHandleSet}, initially empty.
    * @return An empty <code>FederateHandleSet</code>
    */
   public FederateHandleSet
   create();
}
//end FederateHandleSetFactory
```

```
// File: InteractionClassHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Type-safe handle for an interaction class. Generally these are
created by the RTI and passed to the federate.
 * <p>
 * They are obtained from the
 * (10.6) {@link RTIambassador#getInteractionClassHandle
getInteractionClassHandle}
 * method and are used by a variety of other methods.
 * <p>
 * They can also be obtained by using the
<code>InteractionClassHandleFactory</code>'s {@link
ObjectClassHandleFactory#decode decode} method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
InteractionClassHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>InteractionClassHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and
<code>otherInteractionClassHandle</code> represent the same
interaction class handle.
    * @param otherInteractionClassHandle the <code>Object</code> to
compare with
    * @return <code>true</code> iff supplied
<code>otherInteractionClassHandle</code> is of type
<code>InteractionClassHandle</code> and has same value
    */
   public boolean
   equals(Object otherInteractionClassHandle);

   /**
    * Returns a hash code for <code>this</code>; two
<code>InteractionClassHandle</code>s for which <code>equals()</code>
is <code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();
   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>InteractionClassHandle</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end InteractionClassHandle
```

```
// File: InteractionClassHandleFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getInteractionClassHandleFactory
getInteractionClassHandleFactory} method.
 * Its one method creates a new {@link InteractionClassHandle} from a
supplied <code>byte[]</code> representation,
 * itself received as an attribute or parameter value.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
InteractionClassHandleFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link InteractionClassHandle} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of an <code>InteractionClassHandle</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>InteractionClassHandle</code> begins
    * @return An <code>InteractionClassHandle</code> constructed from
the buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public InteractionClassHandle
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode,
             FederateNotExecutionMember;
}
//end InteractionClassHandleFactory
```

```
// File: LogicalTime.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An interface to an immutable time value,
 * one of the four interfaces which the federate implements if it
wishes to translate
 * the federation's logical times and logical time intervals into
something meaningful for itself.
 * It is best if all federates in a given federation use the same
implementations, but it is not strictly necessary.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see LogicalTimeFactory
 */
public interface
LogicalTime
   extends Comparable,
           java.io.Serializable
{
   /**
    * Whether <code>this</code> is the "initial" logical time value or
not (the smallest logical time possible).
    * @return <code>true</code> iff <code>this</code> is the initial
time
    */
   public boolean
   isInitial();

   /**
    * Whether <code>this</code> is the "final" logical time value or
not (the largest logical time possible).
    * @return <code>true</code> iff <code>this</code> is the final
time
    */
   public boolean
   isFinal();

   /**
    * Returns a new <code>LogicalTime</code> whose value is
<code>this</code> moved into the future by the <code>val
LogicalTimeInterval</code>.
    * @param val a <code>LogicalTimeInterval</code> whose value is
"added" to <code>this</code> value
    * @return The <code>LogicalTime</code> resulting from the addition
    * @throws IllegalTimeArithmetic if the result would be beyond the
end time
    */
   public LogicalTime
   add(LogicalTimeInterval val)
      throws IllegalTimeArithmetic;
   /**
    * Returns a new <code>LogicalTime</code> whose value is
<code>this</code> moved into the past by the <code>val
LogicalTimeInterval</code>.
    * @param val a <code>LogicalTimeInterval</code> whose value is
"subtracted" from <code>this</code> value
    * @return The <code>LogicalTime</code> resulting from the
subtraction
    * @throws IllegalTimeArithmetic if the result would be before the
start time
    */
   public LogicalTime
   subtract(LogicalTimeInterval val)
      throws IllegalTimeArithmetic;

   /**
    * Returns a new <code>LogicalTimeInterval</code> whose value is
the logical time interval separating <code>this</code> from
<code>val</code>.
    * <p>
    * Although this is not clearly stated, the resulting logical time
interval is a magnitude (that is, it cannot be negative).
    * Therefore, lti1.distance(lti2) == lti2.distance(lti1)
    * @param val a <code>LogicalTime</code> whose value is compared
with <code>this</code> value
    * @return The <code>LogicalTimeInterval</code> separating the two
<code>LogicalTime</code>s
    */
   public LogicalTimeInterval
   distance(LogicalTime val);

   // Comparable implementation.
   /**
    * Compares <code>this</code> object with the specified
<code>object</code> for order.
    * Later logical time is greater, earlier logical time is smaller.
    * <p>
    * Presumably throws java.lang.ClassCastException if the
<code>other</code> is incommensurable.
    * @param other the <code>object</code> to compare
<code>this</code> with
    * @return A negative, zero or positive integer if
<code>this</code> object is less than, equal to or greater than the
<code>other</code>
    */
   public int
   compareTo(Object other);

   /**
    * Returns a <code>String</code> representation of the
<code>LogicalTime</code>.
    * @return A {@link java.lang.String} representation of
<code>this</code>
    */
   public String
   toString();
   /**
    * Returns true iff <code>this</code> and <code>other</code>
represent the same logical time.
    * @param other the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>other</code> is of
the same type and has the same value
    */
   public boolean
   equals(Object other);

   /**
    * Returns a hash code for <code>this</code>; two
<code>LogicalTime</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>LogicalTime</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end LogicalTime
```

```
// File: LogicalTimeFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * One of the four interfaces which the federate implements if it
wishes to translate
 * the federation's logical times and logical time intervals into
something meaningful for itself.
 * It is best if all federates in a given federation use the same
implementations, but it is not strictly necessary.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
LogicalTimeFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link LogicalTime} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of a <code>LogicalTime</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>LogicalTime</code> begins
    * @return A <code>LogicalTime</code> constructed from the buffer's
contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public LogicalTime
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode;

   /**
    * Creates a new {@link LogicalTime} of "initial" value (the
smallest <code>LogicalTime</code> possible).
    * @return A <code>LogicalTime</code> of initial value
    */
   public LogicalTime
   makeInitial();

   /**
    * Creates a new {@link LogicalTime} of "final" value (the largest
<code>LogicalTime</code> possible).
    * @return A <code>LogicalTime</code> of final value
    */
   public LogicalTime
   makeFinal();
}
//end LogicalTimeFactory
```

```
// File: LogicalTimeInterval.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An interface to an immutable time interval value,
 * one of the four interfaces which the federate implements if it
wishes to translate
 * the federation's logical times and logical time intervals into
something meaningful for itself.
 * It is best if all federates in a given federation use the same
implementations, but it is not strictly necessary.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see LogicalTimeIntervalFactory
 */
public interface
LogicalTimeInterval
   extends Comparable,
           java.io.Serializable
{
   /**
    * Whether <code>this</code> is the zero length logical time
interval or not.
    * @return <code>true</code> iff <code>this</code> is of length
zero
    */
   public boolean
   isZero();

   /**
    * Whether <code>this</code> is the epsilon length logical time
interval or not (epsilon is the smallest non-zero logical time
interval possible).
    * @return <code>true</code> iff <code>this</code> is of length
epsilon
    */
   public boolean
   isEpsilon();

   /**
    * Returns a new <code>LogicalTimeInterval</code> whose value is
<code>(this - subtrahend)</code>.
    * One instance of an <code>LogicalTimeInterval</code> may be
subtracted from another, but not added.
    * <p>
    * Note that what happens when the <code>subtrahend</code> is
larger than <code>this</code> isn't specified.
    * @param subtrahend a <code>LogicalTimeInterval</code> whose value
is subtracted from <code>this</code> value
    * @return The <code>LogicalTimeInterval</code> resulting from the
subtraction
    */
   public LogicalTimeInterval
   subtract(LogicalTimeInterval subtrahend);
   // Comparable implementation

   /**
    * Compares <code>this</code> object with the specified
<code>object</code> for order.
    * @param other the <code>object</code> to compare
<code>this</code> with
    * @return A negative, zero or positive integer if
<code>this</code> object is less than, equal to or greater than the
<code>other</code>
    * @throws java.lang.ClassCastException if the <code>other</code>
is incommensurable
    */
   public int
   compareTo(Object other);

   /**
    * Returns a <code>String</code> representation of the
<code>LogicalTimeInterval</code>.
    * @return A {@link java.lang.String} representation of
<code>this</code>
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and <code>other</code>
represent the same logical time interval.
    * @param other the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>other</code> is of
the same type and has the same value
    */
   public boolean
   equals(Object other);

   /**
    * Returns a hash code for <code>this</code>; two
<code>LogicalTimeInterval</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>LogicalTimeInterval</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();
   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end LogicalTimeInterval
```

```
// File: LogicalTimeIntervalFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * One of the four interfaces which the federate implements if it
wishes to translate
 * the federation's logical times and logical time intervals into
something meaningful for itself.
 * It is best if all federates in a given federation use the same
implementations, but it is not strictly necessary.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
LogicalTimeIntervalFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link LogicalTimeInterval} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of a <code>LogicalTimeInterval</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>LogicalTimeInterval</code> begins
    * @return A <code>LogicalTimeInterval</code> constructed from the
buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public LogicalTimeInterval
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode;

   /**
    * Creates a new {@link LogicalTimeInterval} of value zero.
    * @return A <code>LogicalTimeInterval</code> of value zero
    */
   public LogicalTimeInterval
   makeZero();

   /**
    * Creates a new {@link LogicalTimeInterval} of value epsilon, the
smallest non-zero <code>LogicalTimeInterval</code> possible for this
implementation.
    * @return A <code>LogicalTimeInterval</code> of value epsilon
    */
   public LogicalTimeInterval
   makeEpsilon();
}
//end LogicalTimeIntervalFactory
```

```
// File: MessageRetractionHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * The user can do nothing with these but employ them as keys.
 * Implementers should provide <code>equals</code>,
<code>hashCode</code> and <code>toString</code>
 * rather than settling for the defaults.
 * <p>
 * This object is used by the (8.21) {@link RTIambassador#retract
retract} method.
 * <p>
 * It is also received by the (6.7) {@link
FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,Attribu
teHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,Order
Type,MessageRetractionHandle)},
 * {@link
FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,Attribu
teHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,Order
Type,MessageRetractionHandle,RegionHandleSet)},
 * (6.9) {@link
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderTy
pe,MessageRetractionHandle)},
 * {@link
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderTy
pe,MessageRetractionHandle,RegionHandleSet)}
 * (6.11) {@link
FederateAmbassador#removeObjectInstance(ObjectInstanceHandle,byte[],Or
derType,LogicalTime,OrderType,MessageRetractionHandle)} and
 * (8.22) {@link FederateAmbassador#requestRetraction
requestRetraction}
 * callbacks.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
MessageRetractionHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>MessageRetractionHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();
   /**
    * Returns true iff <code>this</code> and
<code>otherMRHandle</code> represent the same message retraction
handle.
    * @param otherMRHandle The <code>Object</code> to compare with
    * @return true iff supplied <code>otherMRHandle</code> is of type
<code>MessageRetractionHandle</code> and has same value
    */
   public boolean
   equals(Object otherMRHandle);

   /**
    * Returns a hash code for <code>this</code>; two
<code>MessageRetractionHandle</code>s for which <code>equals()</code>
is <code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();
}
//end MessageRetractionHandle
```

The `MessageRetractionReturn` class, unlike the similar `TimeQueryReturn` class and the other IEEE 1516 object classes, does not override the `Object`-inherited `toString`, `equals` and `hashCode` methods. On the assumption that this is an unfortunate oversight, commented-out implementations are provided here.

```
// File: MessageRetractionReturn.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Record returned by the (6.6) {@link
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)},
 * (6.8/9.12) {@link
RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleVa
lueMap,byte[],LogicalTime)} {@link
RTIambassador#sendInteractionWithRegions(InteractionClassHandle,Parame
terHandleValueMap,RegionHandleSet,byte[],LogicalTime) [WithRegions]}
and
 * (6.10) {@link
RTIambassador#deleteObjectInstance(ObjectInstanceHandle,byte[],Logical
Time)} methods.
 * It consists of a guard boolean
(<code>retractionHandleIsValid</code>) and a payload {@link
MessageRetractionHandle} (<code>handle</code>).
 * The latter, if valid, may be used with the (8.21) {@link
RTIambassador#retract retract} method.
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 adds the
java.io.Serializable implementation and a constructor.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
MessageRetractionReturn
   implements java.io.Serializable
{
   /**
    * Whether the other field is valid or not.
    */
   public boolean
   retractionHandleIsValid;

   /**
    * Payload Message Retraction Handle field.
    */
   public MessageRetractionHandle
   handle;
   /**
    * Public constructor.
    * @param rhiv Whether the {@link MessageRetractionHandle} field is
valid or not
    * @param mrh  The <code>MessageRetractionHandle</code> field
    */
   public
   MessageRetractionReturn(boolean                 rhiv,
                           MessageRetractionHandle mrh)
   {
      retractionHandleIsValid = rhiv;
      handle = mrh;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>MessageRetractionReturn</code>.
    * <p>
    * Strangely missing from 1516.1.5 (DoDv2)
    * @return A {@link java.lang.String} with value
"&lt;retractionHandleIsValid&gt; &lt;handle&gt;"
    */
// public String
// toString()
// {
//    return retractionHandleIsValid + " " + handle;
// }
```

```
   /**
    * Returns true iff <code>this</code> and <code>other</code>
represent the same message retraction return.
    * <p>
    * Strangely missing from 1516.1.5 (DoDv2)
    * @param other The <code>Object</code> to compare with
    * @return true iff supplied <code>other</code> is of type
<code>MessageRetractionReturn</code> and has same value
    */
// public boolean
// equals(Object other)
// {
//    if (other instanceof MessageRetractionReturn)
//    {
//       MessageRetractionReturn mrrOther =
(MessageRetractionReturn)other;
//       if ((retractionHandleIsValid == false) &&
(mrrOther.retractionHandleIsValid == false))
//       {
            //When retractionHandleIsValid is false, the payloads are
ignored
//          return true;
//       }
//       else if ((retractionHandleIsValid == true) &&
(mrrOther.retractionHandleIsValid == true))
//       {
            //When retractionHandleIsValid is true, the payloads must
match
//          return handle.equals(mrrOther.handle);
//       }
//       else
//       {
//          //mismatched retractionHandleIsValid fields
//          return false;
//       }
//    }
//    else
//    {
         //Not the same classes
//       return false;
//    }
// }

   /**
    * Returns a hash code for <code>this</code>; two
<code>MessageRetractionReturn</code>s for which <code>equals()</code>
is <code>true</code> should yield the same hash code.
    * <p>
    * Strangely missing from 1516.1.5 (DoDv2)
    * @return An <code>int</code> hash code
    */
// public int
// hashCode()
// {
//    return (retractionHandleValid ? handle.hashCode() : 7);
// }
}
//end MessageRetractionReturn
```

```
// File: MobileFederateServices.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Conveys the interfaces for all services that a federate
 * must supply and which may not execute in the federate's space.
 * This is used by the (4.4) {@link
RTIambassador#joinFederationExecution joinFederationExecution} method.
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 adds the
java.io.Serializable implementation.
 * <p>
 * The Java API is the only one which refers to the {@link
LogicalTimeFactory} and {@link LogicalTimeIntervalFactory}
 * instances being passed to the <code>joinFederationExecution</code>
method as "Mobile Federate Services" (Ada and C++
 * simply pass the instances as separate parameters). It is not clear
either what is meant by "which may
 * not execute" -does it mean they're not allowed to execute in the
federate's space, or does it mean
 * they could be invoked outside of its space? The latter seems more
likely.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
MobileFederateServices
   implements java.io.Serializable
{
   /**
    * The <code>LogicalTimeFactory</code> reference.
    */
   public LogicalTimeFactory
   _timeFactory;

   /**
    * The <code>LogicalTimeIntervalFactory</code> reference.
    */
   public LogicalTimeIntervalFactory
   _intervalFactory;
   /**
    * Public constructor.
    * @param timeFactory An implementation of {@link
LogicalTimeFactory}
    * @param intervalFactory An implementation of {@link
LogicalTimeIntervalFactory}
    */
   public MobileFederateServices(
      LogicalTimeFactory         timeFactory,
      LogicalTimeIntervalFactory intervalFactory)
   {
      _timeFactory = timeFactory;
      _intervalFactory = intervalFactory;
   }
}
//end MobileFederateServices
```

```
// File: ObjectClassHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Type-safe handle for an object class. Generally these are created
by the RTI and passed to the federate.
 * <p>
 * They are obtained from the (10.2) {@link
RTIambassador#getObjectClassHandle getObjectClassHandle} and
 * (10.16) {@link RTIambassador#getKnownObjectClassHandle
getKnownObjectClassHandle}
 * methods and are used by a variety of other methods.
 * <p>
 * They can also be obtained by using the
<code>ObjectClassHandleFactory</code>'s {@link
ObjectClassHandleFactory#decode decode}
 * method on a <code>byte[]</code> received as part of an attribute
update or interaction.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
ObjectClassHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>ObjectClassHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and
<code>otherObjectClassHandle</code> represent the same object class
handle.
    * @param otherObjectClassHandle the <code>Object</code> to compare
with
    * @return <code>true</code> iff supplied
<code>otherObjectClassHandle</code> is of type
<code>ObjectClassHandle</code> and has same value
    */
   public boolean
   equals(Object otherObjectClassHandle);

   /**
    * Returns a hash code for <code>this</code>; two
<code>ObjectClassHandle</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();
   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>ObjectClassHandle</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end ObjectClassHandle
```

```
// File: ObjectClassHandleFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getObjectClassHandleFactory getObjectClassHandleFactory}
method.
 * Its one method creates a new {@link ObjectClassHandle} from a
supplied <code>byte[]</code> representation,
 * itself received as an attribute or parameter value.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
ObjectClassHandleFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link ObjectClassHandle} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of an <code>ObjectClassHandle</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>ObjectClassHandle</code> begins
    * @return An <code>ObjectClassHandle</code> constructed from the
buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public ObjectClassHandle
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode,
             FederateNotExecutionMember;
}
//end ObjectClassHandleFactory
```

```
// File: ObjectInstanceHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Type-safe handle for an object instance. Generally these are
created by the RTI and passed to the federate.
 * <p>
 * They are obtained from the
 * (6.4/9.5) {@link RTIambassador#registerObjectInstance
registerObjectInstance} {@link
RTIambassador#registerObjectInstanceWithRegions [WithRegions]} (all
forms) and
 * (10.10) {@link RTIambassador#getObjectInstanceHandle
getObjectInstanceHandle} methods and are used by a variety of other
methods.
 * <p>
 * They can also be obtained by using the
<code>ObjectInstanceHandleFactory</code>'s {@link
ObjectInstanceHandleFactory#decode decode} method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
ObjectInstanceHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>ObjectInstanceHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and
<code>otherObjectInstanceHandle</code> represent the same object
instance handle.
    * @param otherObjectInstanceHandle the <code>Object</code> to
compare with
    * @return <code>true</code> iff supplied
<code>otherObjectInstanceHandle</code> is of type
<code>ObjectInstanceHandle</code> and has same value
    */
   public boolean
   equals(Object otherObjectInstanceHandle);
   /**
    * Returns a hash code for <code>this</code>; two
<code>ObjectInstanceHandle</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>ObjectInstanceHandle</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end ObjectInstanceHandle
```

```
// File: ObjectInstanceHandleFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getObjectInstanceHandleFactory
getObjectInstanceHandleFactory} method.
 * Its one method creates a new {@link ObjectInstanceHandle} from a
supplied <code>byte[]</code> representation,
 * itself received as an attribute or parameter value.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
ObjectInstanceHandleFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link ObjectInstanceHandle} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of an <code>ObjectInstanceHandle</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>ObjectInstanceHandle</code> begins
    * @return An <code>ObjectInstanceHandle</code> constructed from
the buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public ObjectInstanceHandle
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode,
             FederateNotExecutionMember;
}
//end ObjectInstanceHandleFactory
```

```
// File: OrderType.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the RTI-provided means of ordering messages
originating from multiple joined federates that are delivered to a
single joined federate.
 * Different categories of service are defined with different
characteristics regarding whether and how an RTI orders messages that
are to be delivered to a joined federate.
 * Ordering Type defaults are defined at the attribute and parameter
level by the FOM Document Data; these may be overridden by their
owners.
 * The two OrderTypes are:
 * <ul>
 * <li><code>RECEIVE</code>: Messages are in an arbitrary order but
the general policy is "as soon as possible".
 * <li><code>TIMESTAMP</code>: An effort is made to deliver time-
stamped messages in order of increasing time-stamps
 * </ul>
 * Unlike {@link TransportationType}, the standard does not allow
specific RTIs to define additional OrderTypes.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
OrderType
   implements java.io.Serializable
{
   //each instance's value
   private int _value;
   //initial value for enumeration
   private static final int _lowestValue = 1;
   //begins at lowest
   private static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of an <code>OrderType</code> must be
initialized with one of the defined static values.
    * @param otherOrderTypeValue must be a defined static value or
another instance.
    */
   public OrderType(OrderType otherOrderTypeValue)
   {
      _value = otherOrderTypeValue._value;
   }
   /**
    * Package-only (default access) constructor. Used by the {@link
#decode decode} method.
    * @param value an <code>int</code> to assign to the instance; must
be one of the static values
    */
   OrderType(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("OrderType: illegal value " +
value);
   }

   /**
    * Private constructor; it is used to generate the static values.
    */
   private OrderType()
   {
      _value = _nextToAssign++;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>OrderType</code>.
    * @return A {@link java.lang.String} with value "OrderType(n)"
where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "OrderType(" + _value + ")";
   }

   /**
    * Returns true iff <code>this</code> and
<code>otherOrderTypeValue</code> represent the same order type.
    * @param otherOrderTypeValue the <code>Object</code> to compare
with
    * @return <code>true</code> iff supplied
<code>otherOrderTypeValue</code> is of type <code>OrderType</code> and
has same value
    */
   public boolean
   equals(Object otherOrderTypeValue)
   {
      if (otherOrderTypeValue instanceof OrderType)
         return _value == ((OrderType)otherOrderTypeValue)._value;
      else
         return false;
   }
   /**
    * Returns a hash code for <code>this</code>; two
<code>OrderType</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>OrderType</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength()
   {
      return 1;
   }

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset)
   {
      buffer[offset] = (byte)_value;
   }
   /**
    * Creates an <code>OrderType</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>OrderType</code>
    * @param offset where in the <code>buffer</code> the
<code>OrderType</code> representation begins
    * @return The <code>OrderType</code> that was encoded in the
provided <code>buffer</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    */
   public static OrderType
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode
   {
      int val = buffer[offset];
      OrderType neo;
      try
      {
         neo = new OrderType(val);
      }
      catch (RTIinternalError e)
      {
         throw new CouldNotDecode(e.getMessage());
      }
      return neo;
   }
   //The constant instances
   /**
    * Receive Order (RO).
    * A characteristic of no ordering guarantee for messages.
    * RECEIVE messages will be received in an arbitrary order by the
respective joined federate.
    * A time stamp value will be provided with the message if one was
specified when the message was sent,
    * but that time stamp has no bearing on message receipt order.
    */
   static public final OrderType
   RECEIVE = new OrderType();

   /**
    * Time Stamp Order (TSO).
    * An ordering of messages provided by the runtime infrastructure
(RTI) for joined federates
    * making use of time management services and messages containing
time stamps.
    * TIMESTAMP messages are said to be delivered in TSO if, for any
two messages M1 and M2
    * (time stamped with T1 and T2, respectively) that are delivered
to a single joined federate
    * and where T1 < T2, then M1 is delivered before M2 (in real
time).
    * Messages having the same time stamp will be delivered in an
arbitrary order
    * (i.e., no tie-breaking mechanism is provided by the RTI).
    */
   static public final OrderType
   TIMESTAMP = new OrderType();
}
//end OrderType
```

```
// File: ParameterHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Type-safe handle for a parameter. Generally these are created by
the RTI and passed to the federate.
 * <p>
 * They are obtained from the
 * (10.8) {@link RTIambassador#getParameterHandle getParameterHandle}
when preparing a {@link ParameterHandleValueMap}
 * for transmission through the (6.8) {@link
RTIambassador#sendInteraction sendInteraction} (all forms) method.
 * <p>
 * They can also be obtained directly from the
<code>ParameterHandleValueMap</code> received by the (6.9) {@link
FederateAmbassador#receiveInteraction receiveInteraction} (all forms)
 * or indirectly by using the <code>ParameterHandleFactory</code>'s
{@link ParameterHandleFactory#decode decode} method on a
<code>ParameterHandleValueMap</code>'s values
 * or even a (6.7) {@link FederateAmbassador#reflectAttributeValues
reflectAttributeValues} (all forms) callback's {@link
AttributeHandleValueMap}'s values.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
ParameterHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>ParameterHandle</code>.
    * @return A {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and
<code>otherParameterHandle</code> represent the same parameter handle.
    * Note that two handles may be equals but still refer to different
parameters if used in different interaction class contexts.
    * @param otherParameterHandle the <code>Object</code> to compare
with
    * @return <code>true</code> iff supplied
<code>otherParameterHandle</code> is of type
<code>ParameterHandle</code> and has same value
    */
   public boolean
   equals(Object otherParameterHandle);
   /**
    * Returns a hash code for <code>this</code>; two
<code>ParameterHandle</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>ParameterHandle</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset);
}
//end ParameterHandle
```

```
// File: ParameterHandleFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getParameterHandleFactory getParameterHandleFactory}
method.
 * Its one method creates a new {@link ParameterHandle} from a
supplied <code>byte[]</code> representation,
 * itself received as an attribute or parameter value.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
ParameterHandleFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link ParameterHandle} from the supplied
<code>byte[]</code> representation.
    * @param buffer A <code>byte[]</code> containing a representation
of a <code>ParameterHandle</code>
    * @param offset Offset into the <code>buffer</code> at which the
representation of the <code>ParameterHandle</code> begins
    * @return A <code>ParameterHandle</code> constructed from the
buffer's contents
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public ParameterHandle
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode,
             FederateNotExecutionMember;
}
//end ParameterHandleFactory
```

```
// File: ParameterHandleValueMap.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Object used to transmit the set of parameters and their values
involved in an interaction.
 * Keys are {@link ParameterHandle}s; values are byte[].
 * All {@link java.util.Map} operations are required, none optional.
 * Null mappings are not allowed.
 * <code>put()</code>, <code>putAll()</code>, and
<code>remove()</code> should throw {@link IllegalArgumentException}
 * to enforce types of keys ({@link ParameterHandle}) and mappings
(<code>byte[]</code>).
 * <p>
 * Sent by the
 * (6.8/9.12) {@link RTIambassador#sendInteraction sendInteraction}
{@link RTIambassador#sendInteractionWithRegions [WithRegions]} (all
forms) method.
 * Received by the (6.9) {@link FederateAmbassador#receiveInteraction
receiveInteraction} callback (all forms).
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see ParameterHandleValueMapFactory
 */
public interface
ParameterHandleValueMap
   extends java.lang.Cloneable,
           java.util.Map,
           java.io.Serializable
{
}
//end ParameterHandleValueMap
```

```
// File: ParameterHandleValueMapFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getParameterHandleValueMapFactory
getParameterHandleValueMapFactory} method.
 * Its one method simply creates a new {@link ParameterHandleValueMap}
object.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
ParameterHandleValueMapFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link ParameterHandleValueMap} instance with the
specified initial capacity.
    * @param capacity Initial capacity (number of keys) of the
<code>ParameterHandleValueMap</code>
    * @return A newly created <code>ParameterHandleValueMap</code>
    */
   public ParameterHandleValueMap
   create(int capacity);
}
//end ParameterHandleValueMapFactory
```

```
// File: RangeBounds.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Record returned by the (10.31) {@link RTIambassador#getRangeBounds
getRangeBounds} method
 * and supplied to its (10.32) {@link RTIambassador#setRangeBounds
setRangeBounds} method.
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 adds the
java.io.Serializable implementation and a constructor.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
RangeBounds
   implements java.io.Serializable
{
   /**
    * Lower (included) bound of the range.
    */
   public long lower;

   /**
    * Upper (excluded) bound of the range.
    */
   public long upper;

   /**
    * Public constructor.
    * @param l The range's lower bound (included)
    * @param u The range's upper bound (excluded)
    */
   public RangeBounds(long l,
                      long u)
   {
      lower = l;
      upper = u;
   }
   /**
    * Returns true iff <code>this</code> and <code>other</code>
represent the same set of bounds.
    * @param other The <code>Object</code> to compare with
    * @return true iff supplied <code>other</code> is of type
<code>RangeBounds</code> and has same values
    */
   public boolean
   equals(Object other)
   {
      if ((other != null) && (other instanceof RangeBounds))
      {
         RangeBounds otherRangeBounds = (RangeBounds)other;
         return (lower == otherRangeBounds.lower) && (upper ==
otherRangeBounds.upper);
      }
      else
      {
         return false;
      }
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>RangeBounds</code> for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return (int)(lower + upper);
   }
}
//end RangeBounds
```

```
// File: RegionHandle.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * A designator for an RTI <code>Region</code> object.
 * <p>
 * A <b>region specification</b> is a set of <code>Range</code>s, each
one of which is a continuous semi-open interval (defined by an
included lower bound and an excluded upper bound) on a different
<code>Dimension</code>.
 * A <b>region realization</b> is a region specification that is
associated with an instance attribute for update, with a sent
interaction, or with a class attribute or interaction class for
subscription.
 * The specification and realization may differ when a default range
is specified for a dimension in the FOM Document Data (FDD), since if
that dimension is not mentioned in the region specification, its
default range is implicitly added to the region realization.
 * <p>
 * Region specifications are created, committed and deleted by the
 * (9.2) {@link RTIambassador#createRegion createRegion},
 * (9.3) {@link RTIambassador#commitRegionModifications
commitRegionModifications} and
 * (9.4) {@link RTIambassador#deleteRegion deleteRegion} methods.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
RegionHandle
   extends java.io.Serializable
{
   /**
    * Returns a <code>String</code> representation of the
<code>RegionHandle</code>.
    * @return A {@link java.lang.String} with value reflecting
<code>this</code>
    */
   public String
   toString();

   /**
    * Returns true iff <code>this</code> and
<code>otherRegionHandle</code> refer to the same Region.
    * @param otherRegionHandle The <code>Object</code> to compare with
    * @return true iff supplied <code>otherRegionHandle</code> is of
type <code>RegionHandle</code> and has same value
    */
   public boolean
   equals(Object otherRegionHandle);
   /**
    * Returns a hash code for <code>this</code>; two
<code>RegionHandle</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code
    * (because they then refer to the same Region).
    * @return An <code>int</code> hash code
    */
   public int
   hashCode();
}
//end RegionHandle
```

```
// File: RegionHandleSet.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * A Set of {@link RegionHandle}s.
 * All {@link java.util.Set} operations are required, none are
optional.
 * <code>add()</code> and <code>remove()</code> should throw {@link
IllegalArgumentException} if the argument is not a
<code>RegionHandle</code>.
 * <code>addAll()</code>, <code>removeAll()</code> and
<code>retainAll()</code> should throw
<code>IllegalArgumentException</code> if
 * the argument is not a <code>RegionHandleSet</code>.
 * <p>
 * Used with the (9.3) {@link RTIambassador#commitRegionModifications
commitRegionModifications},
 * (9.10/9.11) {@link
RTIambassador#unsubscribeInteractionClassWithRegions [un]} {@link
RTIambassador#subscribeInteractionClassWithRegions
subscribeInteractionClassWithRegions} {@link
RTIambassador#subscribeInteractionClassPassivelyWithRegions
[Passively]} and
 * (9.12) {@link RTIambassador#sendInteractionWithRegions
sendInteractionWithRegions} (both forms) methods.
 * <p>
 * Also received by certain forms of the (6.7) {@link
FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,Attribu
teHandleValueMap,byte[],OrderType,TransportationType,RegionHandleSet)}
 * and (6.9) {@link
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,RegionHandleSet)}
 * callbacks if the Convey Region Designator Sets Switch is turned on
(this is done through the
 * <code>HLAmanager.HLAfederate.HLAadjust.HLAsetSwitches</code>
Management Object Model (MOM) interaction: there is no special API for
it).
 * These conveyed sets of <code>RegionHandle</code>s can be used with
the
 * (10.31) {@link RTIambassador#getRangeBounds getRangeBounds} and
 * (10.30) {@link RTIambassador#getDimensionHandleSet
getDimensionHandleSet} methods.
 * All other RTIambassador <code>RegionHandle</code> methods expect a
federate-owned <code>Region</code>.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see RegionHandleSetFactory
 */
public interface
RegionHandleSet
   extends java.lang.Cloneable,
           java.io.Serializable,
           java.util.Set
{
}
//end RegionHandleSet
```

```
// File: RegionHandleSetFactory.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Interface corresponding to the {@link
RTIambassador#getRegionHandleSetFactory getRegionHandleSetFactory}
method.
 * Its one method simply creates a new {@link RegionHandleSet} object.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface
RegionHandleSetFactory
   extends java.io.Serializable
{
   /**
    * Creates a new {@link RegionHandleSet} instance.
    * @return A newly created <code>RegionHandleSet</code>
    */
   public RegionHandleSet
   create();
}
//end RegionHandleSetFactory
```

```
// File: ResignAction.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the resign policy adopted by the federate.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see hla.rti1516.RTIambassador#resignFederationExecution
resignFederationExecution
 */
public final class
ResignAction
   implements java.io.Serializable
{
   //each instance's value
   private int _value;
   //initial value for enumeration
   private static final int _lowestValue = 1;
   //begins at lowest
   private static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of a ResignAction must be initialized
with one of the defined static values.
    * @param otherResignActionValue must be a defined static value or
another instance.
    */
   public
   ResignAction(ResignAction otherResignActionValue)
   {
      _value = otherResignActionValue._value;
   }

   /**
    * Package-only (default access) constructor. Unused.
    * @param value to assign to the instance; must be one of the
static ones
    */
   ResignAction(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("ResignAction: illegal value " +
value);
   }
   /**
    * Private constructor; it is used to generate the static values.
    */
   private
   ResignAction()
   {
      _value = _nextToAssign++;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>ResignAction</code>.
    * @return A {@link java.lang.String} with value "ResignAction(n)"
where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "ResignAction(" + _value + ")";
   }

   /**
    * Returns true iff <code>this</code> and
<code>otherResignActionValue</code> represent the same resign action.
    * @param otherResignActionValue The <code>Object</code> to compare
with
    * @return true iff supplied <code>otherResignActionValue</code> is
of type <code>ResignAction</code> and has same value
    */
   public boolean
   equals(Object otherResignActionValue)
   {
      if (otherResignActionValue instanceof ResignAction)
         return _value ==
((ResignAction)otherResignActionValue)._value;
      else
         return false;
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>ResignAction</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }
   //The constant instances
   /**
    * Unconditionally divest ownership of all owned instance
attributes.
    */
   static public final ResignAction
   UNCONDITIONALLY_DIVEST_ATTRIBUTES = new ResignAction();

   /**
    * Delete all object instances for which the joined federate has
the delete privilege.
    */
   static public final ResignAction
   DELETE_OBJECTS = new ResignAction();

   /**
    * Cancel all pending instance attribute ownership acquisitions.
    */
   static public final ResignAction
   CANCEL_PENDING_OWNERSHIP_ACQUISITIONS = new ResignAction();

   /**
    * Perform DELETE_OBJECTS and then
UNCONDITIONALLY_DIVEST_ATTRIBUTES.
    */
   static public final ResignAction
   DELETE_OBJECTS_THEN_DIVEST = new ResignAction();

   /**
    * Perform CANCEL_PENDING_OWNERSHIP_ACQUISITIONS, then
DELETE_OBJECTS and then UNCONDITIONALLY_DIVEST_ATTRIBUTES.
    */
   static public final ResignAction
   CANCEL_THEN_DELETE_THEN_DIVEST = new ResignAction();

   /**
    * Perform no actions.
    */
   static public final ResignAction
   NO_ACTION = new ResignAction();
}
//end ResignAction
```

```
// File: RestoreFailureReason.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the reason why the restore operation of a federate
failed.
 * It is reported by the {@link
FederateAmbassador#federationNotRestored federationNotRestored}
callback.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see hla.rti1516.FederateAmbassador#federationNotRestored
federationNotRestored
 */
public final class
RestoreFailureReason
   implements java.io.Serializable
{
   //each instance's value
   private int _value;
   //initial value for enumeration
   private static final int _lowestValue = 1;
   //begins at lowest
   private static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of a RestoreFailureReason must be
initialized with one of the defined static values.
    * <p>
    * Here we change the parameter name from "otherResignActionValue"
to "reason";
    * this is similar to the change DoD Interpretations of IEEE 1516-
2000v2 applies
    * to the {@link SynchronizationPointFailureReason} constructor.
    * @param reason must be a defined static value or another
instance.
    */
   public
   RestoreFailureReason(RestoreFailureReason reason)
   {
      _value = reason._value;
   }
   /**
    * Package-only (default access) constructor. Unused.
    * @param value to assign to the instance; must be one of the
static ones
    */
   RestoreFailureReason(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("RestoreFailureReason: illegal
value " + value);
   }

   /**
    * Private constructor; it is used to generate the static values.
    */
   private
   RestoreFailureReason()
   {
      _value = _nextToAssign++;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>RestoreFailureReason</code>.
    * @return A {@link java.lang.String} with value
"RestoreFailureReason(n)" where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "RestoreFailureReason(" + _value + ")";
   }
   /**
    * Returns true iff <code>this</code> and
<code>otherRestoreFailureReasonValue</code> represent the same restore
failure reason.
    * <p>
    * Here we change the parameter name from "otherResignActionValue"
to "otherRestoreFailureReasonValue";
    * this follows the same rationale as the change DoD
Interpretations of IEEE 1516-2000v2 applies
    * to the {@link SynchronizationPointFailureReason} constructor.
    * @param otherRestoreFailureReasonValue The <code>Object</code> to
compare with
    * @return true iff supplied
<code>otherRestoreFailureReasonValue</code> is of type
<code>RestoreFailureReason</code> and has same value
    */
   public boolean
   equals(Object otherRestoreFailureReasonValue)
   {
      if (otherRestoreFailureReasonValue instanceof
RestoreFailureReason)
         return _value ==
((RestoreFailureReason)otherRestoreFailureReasonValue)._value;
      else
         return false;
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>RestoreFailureReason</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }
   //The constant instances
   /**
    * The RTI was unable to restore.
    */
   static public final RestoreFailureReason
   RTI_UNABLE_TO_RESTORE = new RestoreFailureReason();

   /**
    * One or more federates have invoked the {@link
RTIambassador#federateRestoreNotComplete federateRestoreNotComplete}
method.
    */
   static public final RestoreFailureReason
   FEDERATE_REPORTED_FAILURE = new RestoreFailureReason();

   /**
    * One or more joined federates have resigned from the federation
execution.
    */
   static public final RestoreFailureReason
   FEDERATE_RESIGNED = new RestoreFailureReason();

   /**
    * The RTI has detected failure at one or more of the joined
federates.
    */
   static public final RestoreFailureReason
   RTI_DETECTED_FAILURE = new RestoreFailureReason();
}
//end RestoreFailureReason
```

```
// File: RestoreStatus.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the restore status of a federate during a federation
restore operation.
 * It is contained in the {@link FederateHandleRestoreStatusPair}[]
argument of the {@link
FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse} callback.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
RestoreStatus
   implements java.io.Serializable
{
   //each instance's value
   private int _value;
   //initial value for enumeration
   private static final int _lowestValue = 1;
   //begins at lowest
   private static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of a RestoreStatus must be
initialized with one of the defined static values.
    * @param otherRestoreStatusValue must be a defined static value or
another instance.
    */
   public RestoreStatus(RestoreStatus otherRestoreStatusValue)
   {
      _value = otherRestoreStatusValue._value;
   }

   /**
    * Package-only (default access) constructor. Unused.
    * @param value to assign to the instance; must be one of the
static ones
    */
   RestoreStatus(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("RestoreStatus: illegal value " +
value);
   }
   /**
    * Private constructor; it is used to generate the static values.
    */
   private RestoreStatus()
   {
      _value = _nextToAssign++;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>RestoreStatus</code>.
    * @return A {@link java.lang.String} with value "RestoreStatus(n)"
where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "RestoreStatus(" + _value + ")";
   }

   /**
    * Returns true iff <code>this</code> and
<code>otherRestoreStatusValue</code> represent the same restore
status.
    * @param otherRestoreStatusValue The <code>Object</code> to
compare with
    * @return true iff supplied <code>other</code> is of type
<code>RestoreStatus</code> and has same value
    */
   public boolean
   equals(Object otherRestoreStatusValue)
   {
      if (otherRestoreStatusValue instanceof RestoreStatus)
         return _value ==
((RestoreStatus)otherRestoreStatusValue)._value;
      else
         return false;
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>RestoreStatus</code>es for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }
   //The constant instances
   /**
    * No restore in progress (federate in the Active state).
    */
   static public final RestoreStatus
   NO_RESTORE_IN_PROGRESS = new RestoreStatus();

   /**
    * Federate in the Restore Request Pending state.
    */
   static public final RestoreStatus
   FEDERATE_RESTORE_REQUEST_PENDING = new RestoreStatus();

   /**
    * Federate in the Waiting For Restore To Begin state.
    */
   static public final RestoreStatus
   FEDERATE_WAITING_FOR_RESTORE_TO_BEGIN = new RestoreStatus();

   /**
    * Federate in the Prepared To Restore state.
    */
   static public final RestoreStatus
   FEDERATE_PREPARED_TO_RESTORE = new RestoreStatus();

   /**
    * Federate in the Restoring state.
    */
   static public final RestoreStatus
   FEDERATE_RESTORING = new RestoreStatus();

   /**
    * Federate in the Waiting For Federation To Restore state.
    */
   static public final RestoreStatus
   FEDERATE_WAITING_FOR_FEDERATION_TO_RESTORE = new RestoreStatus();
}
//end RestoreStatus
```

```
// File: RTIambassador.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Memory Management Conventions for Parameters
 *
 * All Java parameters, including object references, are passed by
value.
 * Therefore there is no need to specify further conventions for
primitive types.
 * Unless otherwise noted, reference parameters adhere to the
following convention:
 * The referenced object is created (or acquired) by the caller. The
callee must
 * copy during the call anything it wishes to save beyond the
completion of the
 * call.
 * Unless otherwise noted, a reference returned from a method
represents a new
 * object created by the callee. The caller is free to modify the
object whose
 * reference is returned.
 */
```

```
/**
 * The RTI presents this interface to the federate.
 * The RTI implementer must implement this.
 * <p>
 * As of DoD Interpretations of IEEE 1516-2000v2, none of the
RTIambassador methods may be called
 * with a <code>null</code> argument, with two exceptions: user-
supplied <code>tag</code> arguments may be <code>null</code>,
 * and the {@link MobileFederateServices} argument of the {@link
#joinFederationExecution joinFederationExecution} service
 * may be <code>null</code> (in the case where the federate does not
wish to supply the {@link LogicalTimeFactory} and {@link
LogicalTimeIntervalFactory}).
 * With the noted exceptions, if a <code>null</code> argument is
supplied, the RTI will throw a {@link java.lang.NullPointerException}.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public interface RTIambassador
{
   ////////////////////////////////////
   // Federation Management Services //
   ////////////////////////////////////

   // 4.2
   /**
    * Creates a federation execution.
    * @param federationExecutionName a {@link java.lang.String}
holding the federation execution's identifier
    * @param fdd a {@link java.net.URL} giving the path to the
federation execution's FOM Document Data (FDD)
    * @throws FederationExecutionAlreadyExists if the specified
federation execution already exists
    * @throws CouldNotOpenFDD if the FDD could not be found or opened
    * @throws ErrorReadingFDD if the FDD is corrupt or otherwise
unusable
    * @throws RTIinternalError if something else goes wrong
    * @see #destroyFederationExecution destroyFederationExecution
    */
   public void
   createFederationExecution(
      String       federationExecutionName,
      java.net.URL fdd)
   throws FederationExecutionAlreadyExists,
          CouldNotOpenFDD,
          ErrorReadingFDD,
          RTIinternalError;
   // 4.3
   /**
    * Destroys a federation execution.
    * @param federationExecutionName a {@link java.lang.String}
holding the federation execution's identifier
    * @throws FederatesCurrentlyJoined if federates are currently
joined to the federation execution
    * @throws FederationExecutionDoesNotExist if the specified
federation execution does not exist
    * @throws RTIinternalError if something else goes wrong
    * @see #createFederationExecution createFederationExecution
    */
   public void
   destroyFederationExecution(
      String federationExecutionName)
   throws FederatesCurrentlyJoined,
          FederationExecutionDoesNotExist,
          RTIinternalError;
   // 4.4
   /**
    * Joins the federate to the federation execution.
    * <p>
    * When a federate is instructed to save its state, the federate-
specific persistent storage must use
    * the save {@link #requestFederationSave(String) label}, the
<code>federateType</code>
    * supplied to this method and the {@link FederateHandle} returned
by this method.
    * When the federation is later restored, there must be the same
number of federates of each
    * <code>federateType</code> joined.
    * @param federateType a {@link java.lang.String} descriptor used
to distinguish federate categories for federation save-and-restore
purposes
    * @param federationExecutionName a <code>String</code> giving the
federation execution's identifier
    * @param federateReference the {@link FederateAmbassador}
interface of the joining federate
    * @param serviceReferences a {@link MobileFederateServices} record
holding the federate-supplied {@link LogicalTimeFactory} and {@link
LogicalTimeIntervalFactory} implementations (this parameter may be
<code>null</code>)
    * @return the joined federate's {@link FederateHandle}
    * @throws FederateAlreadyExecutionMember if the federate (the
{@link RTIambassador} instance) has already joined a federation
execution
    * @throws FederationExecutionDoesNotExist if the specified
federation execution does not exist
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #resignFederationExecution resignFederationExecution
    */
   public FederateHandle
   joinFederationExecution(
      String                 federateType,
      String                 federationExecutionName,
      FederateAmbassador     federateReference,
      MobileFederateServices serviceReferences)
   throws FederateAlreadyExecutionMember,
          FederationExecutionDoesNotExist,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 4.5
   /**
    * Resigns the federate from the federation execution.
    * <p>
    * The possible resignation policies are:
    * <ul>
    * <li> UNCONDITIONALLY_DIVEST_ATTRIBUTES: Unconditionally divest
ownership of all owned instance attributes
    * <li> DELETE_OBJECTS: Delete all object instances for which the
joined federate has the delete privilege
    * <li> CANCEL_PENDING_OWNERSHIP_ACQUISITIONS: Cancel all pending
instance attribute ownership acquisitions
    * <li> DELETE_OBJECTS_THEN_DIVEST: Perform DELETE_OBJECTS and then
UNCONDITIONALLY_DIVEST_ATTRIBUTES
    * <li> CANCEL_THEN_DELETE_THEN_DIVEST: Perform
CANCEL_PENDING_OWNERSHIP_ACQUISITIONS, then DELETE_OBJECTS and then
UNCONDITIONALLY_DIVEST_ATTRIBUTES
    * <li> NO_ACTION: Perform no actions
    * </ul>
    * When UNCONDITIONALLY_DIVEST_ATTRIBUTES occurs, the RTI will try
to transfer ownership to any eligible
    * federates (those that have discovered the object instances);
this means ownership may be granted outright to
    * federates that were already in the "Acquiring" or "Willing To
Acquire" states, and that
    * {@link FederateAmbassador#requestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption}
    * callbacks may be sent as a consequence of this federate's
resignation and of later object instance discoveries.
    * @param resignAction a {@link ResignAction} representing the
federate's resignation policy
    * @throws OwnershipAcquisitionPending if there is an ownership
acquisition pending for some object class (and the federate isn't
cancelling them)
    * @throws FederateOwnsAttributes if the federate owns some
instance attributes (and isn't deleting or divesting them)
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #joinFederationExecution joinFederationExecution
    */
   public void
   resignFederationExecution(
      ResignAction resignAction)
   throws OwnershipAcquisitionPending,
          FederateOwnsAttributes,
          FederateNotExecutionMember,
          RTIinternalError;
   // 4.6
   /**
    * Registers a federation synchronization point. This form concerns
all of the currently joined federates.
    * Synchronization point labels may be pre-defined in the
federation execution's FOM Document Data (FDD) but this isn't a
requirement.
    * @param synchronizationPointLabel a {@link java.lang.String}
holding the synchronization point's identifier
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #synchronizationPointAchieved synchronizationPointAchieved
    * @see
FederateAmbassador#synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see FederateAmbassador#synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see FederateAmbassador#announceSynchronizationPoint
announceSynchronizationPoint
    * @see FederateAmbassador#federationSynchronized
federationSynchronized
    */
   public void
   registerFederationSynchronizationPoint(
      String synchronizationPointLabel,
      byte[] userSuppliedTag)
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Registers a federation synchronization point and specifies a
subset of the currently joined federates.
    * @param synchronizationPointLabel a {@link java.lang.String}
holding the synchronization point's identifier
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param synchronizationSet a {@link FederateHandleSet} holding
the {@link FederateHandle}s of the federates concerned by the
synchronization point
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #synchronizationPointAchieved synchronizationPointAchieved
    * @see
FederateAmbassador#synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see FederateAmbassador#synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see FederateAmbassador#announceSynchronizationPoint
announceSynchronizationPoint
    * @see FederateAmbassador#federationSynchronized
federationSynchronized
    */
   public void
   registerFederationSynchronizationPoint(
      String            synchronizationPointLabel,
      byte[]            userSuppliedTag,
      FederateHandleSet synchronizationSet)
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 4.9
   /**
    * Reports to the RTI that the specified synchronization point has
been achieved.
    * @param synchronizationPointLabel a {@link java.lang.String}
holding the synchronization point's identifier
    * @throws SynchronizationPointLabelNotAnnounced if the RTI does
not recognize the specified <code>synchronizationPointLabel</code>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see
FederateAmbassador#synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see FederateAmbassador#synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see FederateAmbassador#announceSynchronizationPoint
announceSynchronizationPoint
    * @see FederateAmbassador#federationSynchronized
federationSynchronized
    */
   public void
   synchronizationPointAchieved(
      String synchronizationPointLabel)
   throws SynchronizationPointLabelNotAnnounced,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 4.11
   /**
    * Requests that the federation save its current state as soon as
possible under the specified label.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #federateSaveBegun federateSaveBegun
    * @see #federateSaveComplete federateSaveComplete
    * @see #federateSaveNotComplete federateSaveNotComplete
    * @see #queryFederationSaveStatus queryFederationSaveStatus
    * @see FederateAmbassador#initiateFederateSave
initiateFederateSave
    * @see FederateAmbassador#federationSaved federationSaved
    * @see FederateAmbassador#federationNotSaved federationNotSaved
    * @see FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse
    */
   public void
   requestFederationSave(
      String label)
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Requests that the federation save its current state at the
specified logical time under the specified label.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @param theTime the {@link LogicalTime} at which to save the
federation state
    * @throws LogicalTimeAlreadyPassed if the specified
<code>LogicalTime</code> is in the federation's past
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws FederateUnableToUseTime if the specified
<code>LogicalTime</code>, although not in the federate's past, is
nevertheless too soon to be achievable
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #federateSaveBegun federateSaveBegun
    * @see #federateSaveComplete federateSaveComplete
    * @see #federateSaveNotComplete federateSaveNotComplete
    * @see #queryFederationSaveStatus queryFederationSaveStatus
    * @see FederateAmbassador#initiateFederateSave
initiateFederateSave
    * @see FederateAmbassador#federationSaved federationSaved
    * @see FederateAmbassador#federationNotSaved federationNotSaved
    * @see FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse
    */
   public void
   requestFederationSave(
      String      label,
      LogicalTime theTime)
   throws LogicalTimeAlreadyPassed,
          InvalidLogicalTime,
          FederateUnableToUseTime,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 4.13
   /**
    * Signals the RTI that this federate has begun to save its state.
    * @throws SaveNotInitiated if a federation save was not previously
requested
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestFederationSave requestFederationSave
    * @see #federateSaveComplete federateSaveComplete
    * @see #federateSaveNotComplete federateSaveNotComplete
    * @see #queryFederationSaveStatus queryFederationSaveStatus
    * @see FederateAmbassador#initiateFederateSave
initiateFederateSave
    * @see FederateAmbassador#federationSaved federationSaved
    * @see FederateAmbassador#federationNotSaved federationNotSaved
    * @see FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse
    */
   public void
   federateSaveBegun()
   throws SaveNotInitiated,
          FederateNotExecutionMember,
          RestoreInProgress,
          RTIinternalError;

   // 4.14
   /**
    * Signals the RTI that this federate has finished saving its
state.
    * @throws FederateHasNotBegunSave if the federate has not
previously invoked {@link #federateSaveBegun federateSaveBegun}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestFederationSave requestFederationSave
    * @see #federateSaveBegun federateSaveBegun
    * @see #federateSaveNotComplete federateSaveNotComplete
    * @see #queryFederationSaveStatus queryFederationSaveStatus
    * @see FederateAmbassador#initiateFederateSave
initiateFederateSave
    * @see FederateAmbassador#federationSaved federationSaved
    * @see FederateAmbassador#federationNotSaved federationNotSaved
    * @see FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse
    */
   public void
   federateSaveComplete()
   throws FederateHasNotBegunSave,
          FederateNotExecutionMember,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Signals the RTI that this federate was unable to save its state.
    * @throws FederateHasNotBegunSave if the federate has not
previously invoked {@link #federateSaveBegun federateSaveBegun}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestFederationSave requestFederationSave
    * @see #federateSaveBegun federateSaveBegun
    * @see #federateSaveComplete federateSaveComplete
    * @see #queryFederationSaveStatus queryFederationSaveStatus
    * @see FederateAmbassador#initiateFederateSave
initiateFederateSave
    * @see FederateAmbassador#federationSaved federationSaved
    * @see FederateAmbassador#federationNotSaved federationNotSaved
    * @see FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse
    */
   public void
   federateSaveNotComplete()
   throws FederateHasNotBegunSave,
          FederateNotExecutionMember,
          RestoreInProgress,
          RTIinternalError;

   // 4.16
   /**
    * Requests that the federation report on the status of the current
save.
    * <p>
    * In the DoD Interpretations of IEEE 1516-2000v2, the pre-
condition "Save in progress" is dropped, and the exception
<code>SaveNotInProgress</code> is also deleted.
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestFederationSave requestFederationSave
    * @see #federateSaveBegun federateSaveBegun
    * @see #federateSaveComplete federateSaveComplete
    * @see #federateSaveNotComplete federateSaveNotComplete
    * @see FederateAmbassador#initiateFederateSave
initiateFederateSave
    * @see FederateAmbassador#federationSaved federationSaved
    * @see FederateAmbassador#federationNotSaved federationNotSaved
    * @see FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse
    */
   public void
   queryFederationSaveStatus()
   throws FederateNotExecutionMember,
        //SaveNotInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 4.18
   /**
    * Requests that the federation restore its current state to that
saved under the specified label.
    * <p>
    * The federate-specific persistent storage of a federation saved
state must use the save
    * <code>label</code>, the <code>federateType</code> supplied to
the {@link #joinFederationExecution joinFederationExecution}
    * method and the {@link FederateHandle} returned by the same
method.
    * For the restoration request to succeed, there must be the same
number of federates of
    * each {@link #joinFederationExecution federateType} currently
joined.
    * Declaring a federate to be of a given <code>federateType</code>
is therefore equivalent
    * to asserting that it can be restored using the state information
saved by any other
    * federate of that <code>federateType</code>.
    * <p>
    * The RTI saves its own RTI-specific state information when a
federation save succeeds;
    * this information tracks the save <code>label</code>, the {@link
#joinFederationExecution federationExecutionName},
    * the {@link #createFederationExecution fdd} and the census of
joined federates
    * in number and <code>federateType</code>.
    * <p>
    * There is no requirement that a save taken by one RTI
implementation be restorable by another.
```

```
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #federateRestoreComplete federateRestoreComplete
    * @see #federateRestoreNotComplete federateRestoreNotComplete
    * @see #queryFederationRestoreStatus queryFederationRestoreStatus
    * @see FederateAmbassador#requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see FederateAmbassador#requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see FederateAmbassador#federationRestoreBegun
federationRestoreBegun
    * @see FederateAmbassador#initiateFederateRestore
initiateFederateRestore
    * @see FederateAmbassador#federationRestored federationRestored
    * @see FederateAmbassador#federationNotRestored
federationNotRestored
    * @see FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   requestFederationRestore(
      String label)
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 4.22
   /**
    * Signals the RTI that this federate has completed its restore
operation.
    * @throws RestoreNotRequested if a federation restore was not
previously requested
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestFederationRestore requestFederationRestore
    * @see #federateRestoreNotComplete federateRestoreNotComplete
    * @see #queryFederationRestoreStatus queryFederationRestoreStatus
    * @see FederateAmbassador#requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see FederateAmbassador#requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see FederateAmbassador#federationRestoreBegun
federationRestoreBegun
    * @see FederateAmbassador#initiateFederateRestore
initiateFederateRestore
    * @see FederateAmbassador#federationRestored federationRestored
    * @see FederateAmbassador#federationNotRestored
federationNotRestored
    * @see FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federateRestoreComplete()
   throws RestoreNotRequested,
          FederateNotExecutionMember,
          SaveInProgress,
          RTIinternalError;
   /**
    * Signals the RTI that this federate has failed in its restore
operation.
    * @throws RestoreNotRequested if a federation restore was not
previously requested
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestFederationRestore requestFederationRestore
    * @see #federateRestoreComplete federateRestoreComplete
    * @see #queryFederationRestoreStatus queryFederationRestoreStatus
    * @see FederateAmbassador#requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see FederateAmbassador#requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see FederateAmbassador#federationRestoreBegun
federationRestoreBegun
    * @see FederateAmbassador#initiateFederateRestore
initiateFederateRestore
    * @see FederateAmbassador#federationRestored federationRestored
    * @see FederateAmbassador#federationNotRestored
federationNotRestored
    * @see FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federateRestoreNotComplete()
   throws RestoreNotRequested,
          FederateNotExecutionMember,
          SaveInProgress,
          RTIinternalError;
   // 4.24
   /**
    * Requests that the federation report on the status of the current
restore operation.
    * <p>
    * In the DoD Interpretations of IEEE 1516-2000v2, the pre-
condition "Restore in progress" is dropped, and the exception
RestoreNotInProgress is also deleted.
    * <p>
    * The {@link FederateHandle}s used in the {@link
FederateHandleRestoreStatusPair}[] returned by the
    * {@link FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse} callback are the
    * pre-restore ones until all federates have invoked the {@link
RTIambassador#federateRestoreComplete federateRestoreComplete}
    * service. Once all federates have been issued the {@link
FederateAmbassador#federationRestored federationRestored} callbacks,
the post-restore
    * <code>FederateHandle</code>s are used (and each federate's
status will be {@link RestoreStatus NO_RESTORE_IN_PROGRESS}).
    * <p>
    * If this service is invoked between those two times, the {@link
RestoreStatus} and <code>FederateHandle</code>s
    * are unpredictable. A federate should therefore avoid invoking
this service between the moment it invokes the
    * <code>federateRestoreComplete</code> service and the moment it
receives the <code>federationRestored</code>
    * or {@link FederateAmbassador#federationNotRestored
federationNotRestored} callbacks.
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestFederationRestore requestFederationRestore
    * @see #federateRestoreComplete federateRestoreComplete
    * @see #federateRestoreNotComplete federateRestoreNotComplete
    * @see FederateAmbassador#requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see FederateAmbassador#requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see FederateAmbassador#federationRestoreBegun
federationRestoreBegun
    * @see FederateAmbassador#initiateFederateRestore
initiateFederateRestore
    * @see FederateAmbassador#federationRestored federationRestored
    * @see FederateAmbassador#federationNotRestored
federationNotRestored
    * @see FederateAmbassador#federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   queryFederationRestoreStatus()
   throws FederateNotExecutionMember,
          SaveInProgress,
          RTIinternalError;
   //////////////////////////////////////
   // Declaration Management Services //
   //////////////////////////////////////

   // 5.2
   /**
    * Signals to the RTI this federate's intention to start publishing
some attributes of an object class.
    * @param theClass the {@link ObjectClassHandle} of the published
object class
    * @param attributeList an {@link AttributeHandleSet} listing the
published attributes
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #unpublishObjectClass unpublishObjectClass
    * @see #unpublishObjectClassAttributes
unpublishObjectClassAttributes
    */
   public void
   publishObjectClassAttributes(
      ObjectClassHandle  theClass,
      AttributeHandleSet attributeList)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 5.3
   /**
    * Signals to the RTI this federate's intention to stop publishing
any attributes of an object class.
    * Note that this does <i>not</i> trigger
    * {@link FederateAmbassador#requestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption}
    * callbacks for object instance attributes that become unowned.
    * @param theClass the {@link ObjectClassHandle} of the unpublished
object class
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws OwnershipAcquisitionPending if there is an ownership
acquisition pending for the specified object class
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #publishObjectClassAttributes publishObjectClassAttributes
    * @see #unpublishObjectClassAttributes
unpublishObjectClassAttributes
    */
   public void
   unpublishObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotDefined,
          OwnershipAcquisitionPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Signals to the RTI this federate's intention to stop publishing
certain attributes of an object class.
    * Note that this does <i>not</i> trigger
    * {@link FederateAmbassador#requestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption}
    * callbacks for object instance attributes that become unowned.
    * @param theClass the {@link ObjectClassHandle} of the unpublished
object class
    * @param attributeList an {@link AttributeHandleSet} listing the
unpublished attributes
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws OwnershipAcquisitionPending if there is an ownership
acquisition pending for the specified object class attributes
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #publishObjectClassAttributes publishObjectClassAttributes
    * @see #unpublishObjectClass unpublishObjectClass
    */
   public void
   unpublishObjectClassAttributes(
      ObjectClassHandle  theClass,
      AttributeHandleSet attributeList)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          OwnershipAcquisitionPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 5.4
   /**
    * Signals to the RTI this federate's intention to start publishing
an interaction.
    * @param theInteraction the {@link InteractionClassHandle} of the
published interaction
    * @throws InteractionClassNotDefined if
<code>theInteraction</code> isn't recognized by the RTI
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #unpublishInteractionClass unpublishInteractionClass
    * @see FederateAmbassador#turnInteractionsOn turnInteractionsOn
    * @see FederateAmbassador#turnInteractionsOff turnInteractionsOff
    */
   public void
   publishInteractionClass(
      InteractionClassHandle theInteraction)
   throws InteractionClassNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 5.5
   /**
    * Signals to the RTI this federate's intention to stop publishing
an interaction.
    * @param theInteraction the {@link InteractionClassHandle} of the
unpublished interaction
    * @throws InteractionClassNotDefined if
<code>theInteraction</code> isn't recognized by the RTI
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #publishInteractionClass publishInteractionClass
    */
   public void
   unpublishInteractionClass(
      InteractionClassHandle theInteraction)
   throws InteractionClassNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 5.6
   /**
    * Subscribes the federate to certain attributes of an object
class.
    * @param theClass the {@link ObjectClassHandle} of the subscribed
object class
    * @param attributeList an {@link AttributeHandleSet} listing the
subscribed attributes
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeObjectClassAttributesPassively
subscribeObjectClassAttributesPassively
    * @see #subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions
    * @see #subscribeObjectClassAttributesPassivelyWithRegions
subscribeObjectClassAttributesPassivelyWithRegions
    * @see #unsubscribeObjectClass unsubscribeObjectClass
    * @see #unsubscribeObjectClassAttributes
unsubscribeObjectClassAttributes
    * @see #unsubscribeObjectClassAttributesWithRegions
unsubscribeObjectClassAttributesWithRegions
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    * @see FederateAmbassador#attributesInScope attributesInScope
    * @see FederateAmbassador#attributesOutOfScope
attributesOutOfScope
    */
   public void
   subscribeObjectClassAttributes(
      ObjectClassHandle  theClass,
      AttributeHandleSet attributeList)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Subscribes the federate to certain attributes of an object class
without tripping the publishers' object class relevance advisories.
    * <p>
    * Note that if this federate uses this service to switch its
subscription mode from active to passive and it
    * happened to be the last active subscriber, the publisher may
receive a
    * {@link FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass} callback (and possibly
    * one or more {@link
FederateAmbassador#turnUpdatesOffForObjectInstance
turnUpdatesOffForObjectInstance} callbacks).
    * @param theClass the {@link ObjectClassHandle} of the subscribed
object class
    * @param attributeList an {@link AttributeHandleSet} listing the
subscribed attributes
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeObjectClassAttributes
subscribeObjectClassAttributes
    * @see #subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions
    * @see #subscribeObjectClassAttributesPassivelyWithRegions
subscribeObjectClassAttributesPassivelyWithRegions
    * @see #unsubscribeObjectClass unsubscribeObjectClass
    * @see #unsubscribeObjectClassAttributes
unsubscribeObjectClassAttributes
    * @see #unsubscribeObjectClassAttributesWithRegions
unsubscribeObjectClassAttributesWithRegions
    */
   public void
   subscribeObjectClassAttributesPassively(
      ObjectClassHandle  theClass,
      AttributeHandleSet attributeList)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 5.7
   /**
    * Unsubscribes the federate from any attributes of an object
class.
    * @param theClass the {@link ObjectClassHandle} of the
unsubscribed object class
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeObjectClassAttributes
subscribeObjectClassAttributes
    * @see #subscribeObjectClassAttributesPassively
subscribeObjectClassAttributesPassively
    * @see #subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions
    * @see #subscribeObjectClassAttributesPassivelyWithRegions
subscribeObjectClassAttributesPassivelyWithRegions
    * @see #unsubscribeObjectClassAttributes
unsubscribeObjectClassAttributes
    * @see #unsubscribeObjectClassAttributesWithRegions
unsubscribeObjectClassAttributesWithRegions
    */
   public void
   unsubscribeObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Unsubscribes the federate from certain attributes of an object
class.
    * @param theClass the {@link ObjectClassHandle} of the
unsubscribed object class
    * @param attributeList an {@link AttributeHandleSet} listing the
unsubscribed attributes
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeObjectClassAttributes
subscribeObjectClassAttributes
    * @see #subscribeObjectClassAttributesPassively
subscribeObjectClassAttributesPassively
    * @see #subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions
    * @see #subscribeObjectClassAttributesPassivelyWithRegions
subscribeObjectClassAttributesPassivelyWithRegions
    * @see #unsubscribeObjectClass unsubscribeObjectClass
    * @see #unsubscribeObjectClassAttributesWithRegions
unsubscribeObjectClassAttributesWithRegions
    */
   public void
   unsubscribeObjectClassAttributes(
      ObjectClassHandle  theClass,
      AttributeHandleSet attributeList)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 5.8
   /**
    * Subscribes the federate to an interaction.
    * @param theClass the {@link InteractionClassHandle} of the
subscribed interaction
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws FederateServiceInvocationsAreBeingReportedViaMOM if
service invocations are currently being reported via MOM interactions
and <code>theClass</code> is
<code>HLAmanager.HLAfederate.HLAreport.HLAreportServiceInvocation</cod
e>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeInteractionClassPassively
subscribeInteractionClassPassively
    * @see #subscribeInteractionClassWithRegions
subscribeInteractionClassWithRegions
    * @see #subscribeInteractionClassPassivelyWithRegions
subscribeInteractionClassPassivelyWithRegions
    * @see #unsubscribeInteractionClass unsubscribeInteractionClass
    * @see FederateAmbassador#receiveInteraction receiveInteraction
    */
   public void
   subscribeInteractionClass(
      InteractionClassHandle theClass)
   throws InteractionClassNotDefined,
          FederateServiceInvocationsAreBeingReportedViaMOM,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Subscribes the federate to an interaction without tripping the
publishers' interaction relevance advisories.
    * <p>
    * Note that if this federate uses this service to switch its
subscription mode from active to passive and it
    * happened to be the last active subscriber, the publisher may
receive a
    * {@link FederateAmbassador#turnInteractionsOff
turnInteractionsOff} callback.
    * @param theClass the {@link InteractionClassHandle} of the
subscribed interaction
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws FederateServiceInvocationsAreBeingReportedViaMOM if
service invocations are currently being reported via MOM interactions
and <code>theClass</code> is
<code>HLAmanager.HLAfederate.HLAreport.HLAreportServiceInvocation</cod
e>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeInteractionClass subscribeInteractionClass
    * @see #subscribeInteractionClassWithRegions
subscribeInteractionClassWithRegions
    * @see #subscribeInteractionClassPassivelyWithRegions
subscribeInteractionClassPassivelyWithRegions
    * @see #unsubscribeInteractionClass unsubscribeInteractionClass
    * @see FederateAmbassador#receiveInteraction receiveInteraction
    */
   public void
   subscribeInteractionClassPassively(
      InteractionClassHandle theClass)
   throws InteractionClassNotDefined,
          FederateServiceInvocationsAreBeingReportedViaMOM,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 5.9
   /**
    * Unsubscribes the federate from an interaction.
    * @param theClass the {@link InteractionClassHandle} of the
unsubscribed interaction
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeInteractionClass subscribeInteractionClass
    */
   public void
   unsubscribeInteractionClass(
      InteractionClassHandle theClass)
   throws InteractionClassNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   ////////////////////////////////
   // Object Management Services //
   ////////////////////////////////

   // 6.2
   /**
    * Reserves a federation-unique name for a future object instance
registration.
    * <p>
    * Note that although only one federate can successfully reserve an
object instance name,
    * the RTI does not prevent another federate from being the first
to use it during registration.
    * The Pitch pRTI1516 implementation interprets the specification
(which is a little ambiguous)
    * to mean that a name, once reserved, cannot be re-used ever, even
if the registered object
    * is later deleted.
    * @param theObjectName a {@link java.lang.String} holding the
proposed object instance name
    * @throws IllegalName if the <code>theObjectName</code> is ill-
formed (begins with "HLA")
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerObjectInstance registerObjectInstance
    * @see #registerObjectInstanceWithRegions
registerObjectInstanceWithRegions
    * @see #getObjectInstanceName getObjectInstanceName
    * @see FederateAmbassador#objectInstanceNameReservationSucceeded
objectInstanceNameReservationSucceeded
    * @see FederateAmbassador#objectInstanceNameReservationFailed
objectInstanceNameReservationFailed
    */
   public void
   reserveObjectInstanceName(
      String theObjectName)
   throws IllegalName,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.4
   /**
    * Registers a new instance of the specified object class with the
RTI.
    * Note that this does <i>not</i> trigger
    * {@link FederateAmbassador#requestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption}
    * callbacks for object instance attributes that are initially
unowned.
    * @param theClass the {@link ObjectClassHandle} of the object
instance being registered
    * @return the registered object instance's {@link
ObjectInstanceHandle}
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws ObjectClassNotPublished if <code>theClass</code> isn't
published by the federate
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerObjectInstanceWithRegions
registerObjectInstanceWithRegions
    * @see #deleteObjectInstance deleteObjectInstance
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    * @see FederateAmbassador#discoverObjectInstance
discoverObjectInstance
    */
   public ObjectInstanceHandle
   registerObjectInstance(
      ObjectClassHandle theClass)
   throws ObjectClassNotDefined,
          ObjectClassNotPublished,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Registers a new instance of the specified object class with the
RTI, using a previously reserved name.
    * Note that this does <i>not</i> trigger
    * {@link FederateAmbassador#requestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption}
    * callbacks for object instance attributes that are initially
unowned.
    * @param theClass the {@link ObjectClassHandle} of the object
instance being registered
    * @param theObjectName a {@link java.lang.String} holding the
previously reserved object instance name
    * @return the registered object instance's {@link
ObjectInstanceHandle}
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws ObjectClassNotPublished if <code>theClass</code> isn't
published by the federate
    * @throws ObjectInstanceNameNotReserved if
<code>theObjectName</code> has not been previously reserved
    * @throws ObjectInstanceNameInUse if <code>theObjectName</code> is
already in use
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerObjectInstanceWithRegions
registerObjectInstanceWithRegions
    * @see #reserveObjectInstanceName reserveObjectInstanceName
    * @see #deleteObjectInstance deleteObjectInstance
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    * @see FederateAmbassador#discoverObjectInstance
discoverObjectInstance
    */
   public ObjectInstanceHandle
   registerObjectInstance(
      ObjectClassHandle theClass,
      String            theObjectName)
   throws ObjectClassNotDefined,
          ObjectClassNotPublished,
          ObjectInstanceNameNotReserved,
          ObjectInstanceNameInUse,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.6
   /**
    * Provides the RTI with updated values for certain instance
attributes.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleValueMap} holding
the updated values, keyed by attribute
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see FederateAmbassador#turnUpdatesOnForObjectInstance
turnUpdatesOnForObjectInstance
    * @see FederateAmbassador#turnUpdatesOffForObjectInstance
turnUpdatesOffForObjectInstance
    * @see FederateAmbassador#reflectAttributeValues
reflectAttributeValues
    */
   public void
   updateAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Provides the RTI with updated values for certain instance
attributes at a specified time-stamp.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleValueMap} holding
the updated values, keyed by attribute
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param theTime the {@link LogicalTime} at which the updated
values become valid
    * @return the message's {@link MessageRetractionReturn}, should a
retraction become necessary
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #retract retract
    * @see FederateAmbassador#turnUpdatesOnForObjectInstance
turnUpdatesOnForObjectInstance
    * @see FederateAmbassador#turnUpdatesOffForObjectInstance
turnUpdatesOffForObjectInstance
    * @see FederateAmbassador#reflectAttributeValues
reflectAttributeValues
    */
   public MessageRetractionReturn
   updateAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      LogicalTime             theTime)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          InvalidLogicalTime,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.8
   /**
    * Sends an interaction. Note that the sender may send a subset of
the interaction's available parameters.
    * @param theInteraction the {@link InteractionClassHandle} of the
interaction being sent
    * @param theParameters a {@link ParameterHandleValueMap} holding
the interaction values, keyed by parameter
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws InteractionClassNotPublished if the federate does not
publish <code>theInteraction</code>
    * @throws InteractionClassNotDefined if
<code>theInteraction</code> isn't recognized by the RTI
    * @throws InteractionParameterNotDefined if one of
<code>theParameters</code> isn't recognized in the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #sendInteractionWithRegions sendInteractionWithRegions
    * @see FederateAmbassador#turnInteractionsOn turnInteractionsOn
    * @see FederateAmbassador#turnInteractionsOff turnInteractionsOff
    * @see
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType)
    */
   public void
   sendInteraction(
      InteractionClassHandle  theInteraction,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag)
   throws InteractionClassNotPublished,
          InteractionClassNotDefined,
          InteractionParameterNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Sends an interaction at a specified time-stamp.
    * @param theInteraction the {@link InteractionClassHandle} of the
interaction being sent
    * @param theParameters a {@link ParameterHandleValueMap} holding
the interaction values, keyed by parameter
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @return the message's {@link MessageRetractionReturn}, should a
retraction become necessary
    * @throws InteractionClassNotPublished if the federate does not
publish <code>theInteraction</code>
    * @throws InteractionClassNotDefined if
<code>theInteraction</code> isn't recognized by the RTI
    * @throws InteractionParameterNotDefined if one of
<code>theParameters</code> isn't recognized in the supplied context
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #retract retract
    * @see #sendInteractionWithRegions sendInteractionWithRegions
    * @see FederateAmbassador#turnInteractionsOn turnInteractionsOn
    * @see FederateAmbassador#turnInteractionsOff turnInteractionsOff
    * @see
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderTy
pe)
    */
   public MessageRetractionReturn
   sendInteraction(
      InteractionClassHandle  theInteraction,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      LogicalTime             theTime)
   throws InteractionClassNotPublished,
          InteractionClassNotDefined,
          InteractionParameterNotDefined,
          InvalidLogicalTime,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.10
   /**
    * Notifies the RTI that an object instance is to be deleted.
    * @param objectHandle the {@link ObjectInstanceHandle} of the
object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws DeletePrivilegeNotHeld if the federate does not own the
<code>HLAprivilegeToDeleteObject</code> attribute of the specified
object instance
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerObjectInstance registerObjectInstance
    * @see #registerObjectInstanceWithRegions
registerObjectInstanceWithRegions
    * @see FederateAmbassador#removeObjectInstance
removeObjectInstance
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    */
   public void
   deleteObjectInstance(
      ObjectInstanceHandle objectHandle,
      byte[]               userSuppliedTag)
   throws DeletePrivilegeNotHeld,
          ObjectInstanceNotKnown,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Notifies the RTI that an object instance is to be deleted at a
specified time-stamp.
    * @param objectHandle the {@link ObjectInstanceHandle} of the
object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param theTime the {@link LogicalTime} at which the object
instance is deleted
    * @return the message's {@link MessageRetractionReturn}, should a
retraction become necessary
    * @throws DeletePrivilegeNotHeld if the federate does not own the
<code>HLAprivilegeToDeleteObject</code> attribute of the specified
object instance
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerObjectInstance registerObjectInstance
    * @see #registerObjectInstanceWithRegions
registerObjectInstanceWithRegions
    * @see #retract retract
    * @see FederateAmbassador#removeObjectInstance
removeObjectInstance
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    */
   public MessageRetractionReturn
   deleteObjectInstance(
      ObjectInstanceHandle objectHandle,
      byte[]               userSuppliedTag,
      LogicalTime          theTime)
   throws DeletePrivilegeNotHeld,
          ObjectInstanceNotKnown,
          InvalidLogicalTime,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.12
   /**
    * Notifies the RTI that the federate has "forgotten" all about a
subscribed object instance and should therefore discover it anew.
    * @param objectHandle the {@link ObjectInstanceHandle} of the
object instance
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws FederateOwnsAttributes if the federate owns some
instance attributes of the specified object instance
    * @throws OwnershipAcquisitionPending if there is an ownership
acquisition pending for some instance attribute of the specified
object instance
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see FederateAmbassador#discoverObjectInstance
discoverObjectInstance
    */
   public void
   localDeleteObjectInstance(
      ObjectInstanceHandle objectHandle)
   throws ObjectInstanceNotKnown,
          FederateOwnsAttributes,
          OwnershipAcquisitionPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.13
   /**
    * Notifies the RTI that future {@link #updateAttributeValues
updateAttributeValues} invocations should use the specified {@link
TransportationType}.
    * <p>
    * The attribute transportation types revert to their FDD-specified
values once this federate loses ownership.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @param theType the {@link TransportationType} to which
<code>theAttributes</code> should switch
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #changeAttributeOrderType changeAttributeOrderType
    * @see #changeInteractionTransportationType
changeInteractionTransportationType
    */
   public void
   changeAttributeTransportationType(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      TransportationType   theType)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.14
   /**
    * Notifies the RTI that future {@link #sendInteraction
sendInteraction} invocations should use the specified {@link
TransportationType}.
    * @param theClass the {@link InteractionClassHandle} of the
subject interaction
    * @param theType the {@link TransportationType} to which
<code>theClass</code> should switch
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws InteractionClassNotPublished if the federate does not
publish <code>theClass</code>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #changeInteractionOrderType changeInteractionOrderType
    * @see #changeAttributeTransportationType
changeAttributeTransportationType
    */
   public void
   changeInteractionTransportationType(
      InteractionClassHandle theClass,
      TransportationType     theType)
   throws InteractionClassNotDefined,
          InteractionClassNotPublished,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 6.17
   /**
    * Requests that attribute value updates be provided for the
specified instance attributes.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the attributes for which value updates are requested
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestAttributeValueUpdateWithRegions
requestAttributeValueUpdateWithRegions
    * @see FederateAmbassador#provideAttributeValueUpdate
provideAttributeValueUpdate
    */
   public void
   requestAttributeValueUpdate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Requests that attribute value updates be provided for all
instance attributes of the specified object class.
    * @param theClass the {@link ObjectClassHandle} of the object
class being polled
    * @param theAttributes an {@link AttributeHandleSet} listing the
attributes being polled
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestAttributeValueUpdateWithRegions
requestAttributeValueUpdateWithRegions
    * @see FederateAmbassador#provideAttributeValueUpdate
provideAttributeValueUpdate
    */
   public void
   requestAttributeValueUpdate(
      ObjectClassHandle  theClass,
      AttributeHandleSet theAttributes,
      byte[]             userSuppliedTag)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   //////////////////////////////////
   // Ownership Management Services //
   //////////////////////////////////

   // 7.2
   /**
    * Notifies the RTI that the federate immediately divests itself of
ownership of the specified instance attributes.
    * The RTI may issue {@link
FederateAmbassador#requestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption}
    * callbacks at eligible joined federates for object instance
attributes that become unowned.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the divested attributes
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    */
   public void
   unconditionalAttributeOwnershipDivestiture(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.3
   /**
    * Notifies the RTI that the federate wishes to relinquish
ownership of the specified instance attributes to any other willing
federate(s).
    * The RTI may issue {@link
FederateAmbassador#requestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption}
    * callbacks at eligible joined federates for the specified object
instance attributes.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the attributes to divest
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws AttributeAlreadyBeingDivested if an attribute ownership
divestiture request is already pending for one of the attribute
instances
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see FederateAmbassador#requestDivestitureConfirmation
requestDivestitureConfirmation
    * @see #confirmDivestiture confirmDivestiture
    * @see #cancelNegotiatedAttributeOwnershipDivestiture
cancelNegotiatedAttributeOwnershipDivestiture
    * @see #unpublishObjectClassAttributes
unpublishObjectClassAttributes
    */
   public void
   negotiatedAttributeOwnershipDivestiture(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          AttributeAlreadyBeingDivested,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.6
   /**
    * Completes the negotiated divestiture of the specified instance
attributes.
    * <p>
    * In the DoD Interpretations of IEEE 1516-2000v2, the exception
NoAcquisitionPending is added.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the confirmed attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws AttributeDivestitureWasNotRequested if the divestiture
was not previously requested by the federate
    * @throws NoAcquisitionPending if the RTI has not yet located
candidate federates
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #negotiatedAttributeOwnershipDivestiture
negotiatedAttributeOwnershipDivestiture
    * @see FederateAmbassador#requestDivestitureConfirmation
requestDivestitureConfirmation
    */
   public void
   confirmDivestiture(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          AttributeDivestitureWasNotRequested,
          NoAcquisitionPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.8
   /**
    * Notifies the RTI that the federate wishes to acquire ownership
of the specified instance attributes.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param desiredAttributes an {@link AttributeHandleSet}
specifying the desired attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws ObjectClassNotPublished if <code>theClass</code> isn't
published by the federate
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotPublished if an attribute is not published
by the federate
    * @throws FederateOwnsAttributes if the federate already owns some
of the specified instance attributes
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see FederateAmbassador#requestAttributeOwnershipRelease
requestAttributeOwnershipRelease
    * @see
FederateAmbassador#attributeOwnershipAcquisitionNotification
attributeOwnershipAcquisitionNotification
    * @see #cancelAttributeOwnershipAcquisition
cancelAttributeOwnershipAcquisition
    */
   public void
   attributeOwnershipAcquisition(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   desiredAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          ObjectClassNotPublished,
          AttributeNotDefined,
          AttributeNotPublished,
          FederateOwnsAttributes,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.9
   /**
    * Notifies the RTI that the federate wishes to acquire ownership
of the specified instance attributes,
    * but only if they are currently unowned or in the process of
being divested.
    * <p>
    * Attributes made available through {@link
#negotiatedAttributeOwnershipDivestiture} are eligible for acquisition
in this manner.
    * Other federates aren't bothered by this call; the requesting
federate receives {@link
FederateAmbassador#attributeOwnershipUnavailable}
    * for those attributes which are currently owned by other
federates, {@link
FederateAmbassador#attributeOwnershipAcquisitionNotification}
    * for the unowned ones, and no response for those attributes which
do not currently exist.
    * Note also that the owning federate may stay in the Completing
Divestiture state indefinitely (i.e. it postpones
    * emitting {@link #confirmDivestiture} indefinitely); the
requesting federate won't receive any callbacks during that time.
    * It is not clear whether {@link
#cancelAttributeOwnershipAcquisition} (whilst the requesting federate
is awaiting a response)
    * would raise an {@link AttributeAcquisitionWasNotRequested}
exception or not.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param desiredAttributes an {@link AttributeHandleSet}
specifying the desired attributes
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws ObjectClassNotPublished if <code>theClass</code> isn't
published by the federate
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotPublished if an attribute is not published
by the federate
    * @throws FederateOwnsAttributes if the federate already owns some
of the specified instance attributes
    * @throws AttributeAlreadyBeingAcquired if an unconditional
attribute ownership acquisition request is already pending for an
attribute instance
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see
FederateAmbassador#attributeOwnershipAcquisitionNotification
attributeOwnershipAcquisitionNotification
    * @see FederateAmbassador#attributeOwnershipUnavailable
attributeOwnershipUnavailable
    * @see #cancelAttributeOwnershipAcquisition
cancelAttributeOwnershipAcquisition
    */
   public void
   attributeOwnershipAcquisitionIfAvailable(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   desiredAttributes)
   throws ObjectInstanceNotKnown,
          ObjectClassNotPublished,
          AttributeNotDefined,
          AttributeNotPublished,
          FederateOwnsAttributes,
          AttributeAlreadyBeingAcquired,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.12
   /**
    * Notifies the RTI that the federate is willing to relinquish
ownership of the specified instance attributes
    * if any other federates are attempting to acquire them. The
method concludes the divestiture immediately one way or another.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the offered attributes
    * @return an {@link AttributeHandleSet} specifying the attributes
successfully divested
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see FederateAmbassador#requestAttributeOwnershipRelease
requestAttributeOwnershipRelease
    */
   public AttributeHandleSet
   attributeOwnershipDivestitureIfWanted(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.13
   /**
    * Notifies the RTI that the federate is cancelling the outstanding
{@link #negotiatedAttributeOwnershipDivestiture
negotiatedAttributeOwnershipDivestiture} of
    * the specified instance attributes.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the attributes for which divestiture is canceled
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws AttributeDivestitureWasNotRequested if the divestiture
was not previously requested by the federate
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #negotiatedAttributeOwnershipDivestiture
negotiatedAttributeOwnershipDivestiture
    */
   public void
   cancelNegotiatedAttributeOwnershipDivestiture(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          AttributeDivestitureWasNotRequested,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.14
   /**
    * Notifies the RTI that the federate is cancelling the outstanding
{@link #attributeOwnershipAcquisition attributeOwnershipAcquisition}
of
    * the specified instance attributes.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the attributes for which acquisition is canceled
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeAlreadyOwned if the cancellation occurs too
late (i.e. it has already been granted ownership)
    * @throws AttributeAcquisitionWasNotRequested if there is no
pending attribute ownership acquisition to cancel
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #attributeOwnershipAcquisition
attributeOwnershipAcquisition
    * @see
FederateAmbassador#confirmAttributeOwnershipAcquisitionCancellation
confirmAttributeOwnershipAcquisitionCancellation
    */
   public void
   cancelAttributeOwnershipAcquisition(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotRequested,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.16
   /**
    * Requests that the RTI report the ownership status of the
specified instance attribute.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttribute an {@link AttributeHandle} specifying the
queried attribute
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see FederateAmbassador#informAttributeOwnership
informAttributeOwnership
    * @see FederateAmbassador#attributeIsNotOwned attributeIsNotOwned
    * @see FederateAmbassador#attributeIsOwnedByRTI
attributeIsOwnedByRTI
    */
   public void
   queryAttributeOwnership(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 7.18
   /**
    * Requests that the RTI report whether or not the federate owns
the specified instance attribute.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttribute an {@link AttributeHandle} specifying the
queried attribute
    * @return <code>true</code> iff <code>theAttribute</code> is owned
by the federate
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    */
   public boolean
   isAttributeOwnedByFederate(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   //////////////////////////////
   // Time Management Services //
   //////////////////////////////

   // 8.2
   /**
    * Requests that this federate become time-regulating (with the
specified lookahead),
    * thereby enabling it to send time-stamped messages.
    * @param theLookahead a {@link LogicalTimeInterval} specifying the
new lookahead
    * @throws TimeRegulationAlreadyEnabled if time regulation is
already enabled
    * @throws InvalidLookahead if <code>theLookahead</code> is invalid
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws RequestForTimeRegulationPending if a time regulation
request is pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableTimeRegulation disableTimeRegulation
    * @see FederateAmbassador#timeRegulationEnabled
timeRegulationEnabled
    */
   public void
   enableTimeRegulation(
      LogicalTimeInterval theLookahead)
   throws TimeRegulationAlreadyEnabled,
          InvalidLookahead,
          InTimeAdvancingState,
          RequestForTimeRegulationPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.4
   /**
    * Requests that this federate no longer be time-regulating,
    * thereby making its future messages receive-ordered.
    * @throws TimeRegulationIsNotEnabled if time regulation is
currently disabled
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableTimeRegulation enableTimeRegulation
    */
   public void
   disableTimeRegulation()
   throws TimeRegulationIsNotEnabled,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 8.5
   /**
    * Requests that this federate become time-constrained.
    * @throws TimeConstrainedAlreadyEnabled if time constraint is
already enabled
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws RequestForTimeConstrainedPending if a time constraint
request is pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableTimeConstrained disableTimeConstrained
    * @see FederateAmbassador#timeConstrainedEnabled
timeConstrainedEnabled
    */
   public void
   enableTimeConstrained()
   throws TimeConstrainedAlreadyEnabled,
          InTimeAdvancingState,
          RequestForTimeConstrainedPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.7
   /**
    * Requests that this federate no longer be time-constrained.
    * @throws TimeConstrainedIsNotEnabled if time constraint is
currently disabled
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableTimeConstrained enableTimeConstrained
    */
   public void
   disableTimeConstrained()
   throws TimeConstrainedIsNotEnabled,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.8
   /**
    * Requests an advance of the federate's logical time to the
specified value,
    * thereby releasing queued messages of appropriate time-stamps.
    * <p>
    * The federate is guaranteeing that it will not later generate a
    * {@link OrderType TIMESTAMP} message with a time stamp less than
or equal to
    * the specified logical time, even if its lookahead is zero.
    * A Time Advance Grant completes this request and indicates to the
federate
    * that no additional {@link OrderType TIMESTAMP} messages will be
later delivered
    * to it with time stamps less than or equal to the logical time of
the grant.
    * @param theTime the {@link LogicalTime} to which the federate
wishes to advance
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws LogicalTimeAlreadyPassed if the specified
<code>LogicalTime</code> is in the federation's past
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws RequestForTimeRegulationPending if a time regulation
request is pending
    * @throws RequestForTimeConstrainedPending if a time constraint
request is pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #timeAdvanceRequestAvailable timeAdvanceRequestAvailable
    * @see #nextMessageRequest nextMessageRequest
    * @see #nextMessageRequestAvailable nextMessageRequestAvailable
    * @see #flushQueueRequest flushQueueRequest
    * @see FederateAmbassador#timeAdvanceGrant timeAdvanceGrant
    */
   public void
   timeAdvanceRequest(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          LogicalTimeAlreadyPassed,
          InTimeAdvancingState,
          RequestForTimeRegulationPending,
          RequestForTimeConstrainedPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.9
   /**
    * Requests an advance of the federate's logical time to the
specified value,
    * thereby releasing queued messages of appropriate time-stamps,
whilst allowing
    * current-time messages to still be exchanged.
    * <p>
    * timeAdvanceRequestAvailable is similar to timeAdvanceRequest,
except that
    * the RTI does not guarantee delivery of <i>all</i> messages with
time stamps
    * <i>equal to</i> the logical time granted. The federate is also
allowed to
    * send additional messages with time stamps equal to the logical
time granted,
    * if the federate's actual lookahead is zero.
    * @param theTime the {@link LogicalTime} to which the federate
wishes to advance
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws LogicalTimeAlreadyPassed if the specified
<code>LogicalTime</code> is in the federation's past
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws RequestForTimeRegulationPending if a time regulation
request is pending
    * @throws RequestForTimeConstrainedPending if a time constraint
request is pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #timeAdvanceRequest timeAdvanceRequest
    * @see #nextMessageRequest nextMessageRequest
    * @see #nextMessageRequestAvailable nextMessageRequestAvailable
    * @see #flushQueueRequest flushQueueRequest
    * @see FederateAmbassador#timeAdvanceGrant timeAdvanceGrant
    */
   public void
   timeAdvanceRequestAvailable(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          LogicalTimeAlreadyPassed,
          InTimeAdvancingState,
          RequestForTimeRegulationPending,
          RequestForTimeConstrainedPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.10
   /**
    * Notifies the RTI that the federate wishes to advance to the
lesser {@link LogicalTime} of
    * the one specified and the next time-stamped message awaiting
delivery.
    * <p>
    * nextMessageRequest is similar to timeAdvanceRequest except that
the time advance granted
    * is a function of the time-stamp of the next {@link OrderType
TIMESTAMP} message awaiting delivery.
    * @param theTime the {@link LogicalTime} beyond which the federate
does not wish to advance
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws LogicalTimeAlreadyPassed if the specified
<code>LogicalTime</code> is in the federation's past
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws RequestForTimeRegulationPending if a time regulation
request is pending
    * @throws RequestForTimeConstrainedPending if a time constraint
request is pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #nextMessageRequestAvailable nextMessageRequestAvailable
    * @see #timeAdvanceRequest timeAdvanceRequest
    * @see #timeAdvanceRequestAvailable timeAdvanceRequestAvailable
    * @see #flushQueueRequest flushQueueRequest
    * @see FederateAmbassador#timeAdvanceGrant timeAdvanceGrant
    */
   public void
   nextMessageRequest(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          LogicalTimeAlreadyPassed,
          InTimeAdvancingState,
          RequestForTimeRegulationPending,
          RequestForTimeConstrainedPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.11
   /**
    * Notifies the RTI that the federate wishes to advance to the
lesser {@link LogicalTime} of
    * the one specified and the next time-stamped message awaiting
delivery, whilst allowing
    * current-time messages to still be exchanged.
    * <p>
    * nextMessageRequestAvailable is similar to
timeAdvanceRequestAvailable except that the time advance
    * granted is a function of the time-stamp of the next {@link
OrderType TIMESTAMP} message awaiting delivery.
    * @param theTime the {@link LogicalTime} beyond which the federate
does not wish to advance
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws LogicalTimeAlreadyPassed if the specified
<code>LogicalTime</code> is in the federation's past
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws RequestForTimeRegulationPending if a time regulation
request is pending
    * @throws RequestForTimeConstrainedPending if a time constraint
request is pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #nextMessageRequest nextMessageRequest
    * @see #timeAdvanceRequest timeAdvanceRequest
    * @see #timeAdvanceRequestAvailable timeAdvanceRequestAvailable
    * @see #flushQueueRequest flushQueueRequest
    * @see FederateAmbassador#timeAdvanceGrant timeAdvanceGrant
    */
   public void
   nextMessageRequestAvailable(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          LogicalTimeAlreadyPassed,
          InTimeAdvancingState,
          RequestForTimeRegulationPending,
          RequestForTimeConstrainedPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.12
   /**
    * Notifies the RTI that the federate wishes to advance to the
lesser {@link LogicalTime} of
    * the one specified and the next time-stamped message awaiting
delivery, but should nevertheless
    * receive all currently-queued time-stamped messages awaiting
delivery.
    * <p>
    * flushQueueRequest is similar to nextMessageRequest except that
some anticipated messages may be received.
    * As a consequence, later time-stamped messages may not be
received in the "correct" order.
    * @param theTime the {@link LogicalTime} beyond which the federate
does not wish to advance
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws LogicalTimeAlreadyPassed if the specified
<code>LogicalTime</code> is in the federation's past
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws RequestForTimeRegulationPending if a time regulation
request is pending
    * @throws RequestForTimeConstrainedPending if a time constraint
request is pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #nextMessageRequest nextMessageRequest
    * @see #nextMessageRequestAvailable nextMessageRequestAvailable
    * @see #timeAdvanceRequest timeAdvanceRequest
    * @see #timeAdvanceRequestAvailable timeAdvanceRequestAvailable
    * @see FederateAmbassador#timeAdvanceGrant timeAdvanceGrant
    */
   public void
   flushQueueRequest(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          LogicalTimeAlreadyPassed,
          InTimeAdvancingState,
          RequestForTimeRegulationPending,
          RequestForTimeConstrainedPending,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.14
   /**
    * Instructs the RTI to deliver {@link OrderType RECEIVE} messages
when the federate is in either of the
    * Time Advancing and Time Granted states.
    * @throws AsynchronousDeliveryAlreadyEnabled if asynchronous
delivery is already enabled
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableAsynchronousDelivery disableAsynchronousDelivery
    */
   public void
   enableAsynchronousDelivery()
   throws AsynchronousDeliveryAlreadyEnabled,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 8.15
   /**
    * Instructs the RTI to deliver {@link OrderType RECEIVE} messages
only when the federate is in the
    * Time Advancing state. This is only applicable to time-
constrained federates.
    * @throws AsynchronousDeliveryAlreadyDisabled if asynchronous
delivery is already disabled
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableAsynchronousDelivery enableAsynchronousDelivery
    */
   public void
   disableAsynchronousDelivery()
   throws AsynchronousDeliveryAlreadyDisabled,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.16
   /**
    * Requests the federate's current GALT (Greatest Available Logical
Time).
    * @return a {@link TimeQueryReturn} containing the requested
logical time and a validity guard boolean
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    */
   public TimeQueryReturn
   queryGALT()
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 8.17
   /**
    * Requests the federate's current logical time.
    * @return the requested {@link LogicalTime}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    */
   public LogicalTime
   queryLogicalTime()
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.18
   /**
    * Requests the federate's current LITS (Least Incoming Time
Stamp).
    * @return a {@link TimeQueryReturn} containing the requested
logical time and a validity guard boolean
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    */
   public TimeQueryReturn
   queryLITS()
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 8.19
   /**
    * Requests a change to the federate's lookahead.
    * If the new lookahead is smaller than the current one, the change
will come about gradually.
    * The federate's lookahead will shrink every time its logical time
advances so that the
    * federate's "future" remains at a constant logical time, until
the specified lookahead
    * value is reached.
    * @param theLookahead a {@link LogicalTimeInterval} specifying the
requested new lookahead
    * @throws TimeRegulationIsNotEnabled if time regulation is
currently disabled
    * @throws InvalidLookahead if <code>theLookahead</code> is invalid
    * @throws InTimeAdvancingState if the federate is in the time-
advancing state
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #queryLookahead queryLookahead
    */
   public void
   modifyLookahead(
      LogicalTimeInterval theLookahead)
   throws TimeRegulationIsNotEnabled,
          InvalidLookahead,
          InTimeAdvancingState,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.20
   /**
    * Requests the federate's current lookahead.
    * @return the requested {@link LogicalTimeInterval}
    * @throws TimeRegulationIsNotEnabled if time regulation is
currently disabled
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #modifyLookahead modifyLookahead
    */
   public LogicalTimeInterval
   queryLookahead()
   throws TimeRegulationIsNotEnabled,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 8.21
   /**
    * Notifies the RTI that a message previously sent by the joined
federate is to be retracted.
    * @param theHandle the {@link MessageRetractionHandle} of the
message to retract
    * @throws InvalidMessageRetractionHandle if the
<code>MessageRetractionHandle</code> is invalid
    * @throws TimeRegulationIsNotEnabled if time regulation is
currently disabled
    * @throws MessageCanNoLongerBeRetracted the message specified can
no longer be retracted
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see FederateAmbassador#requestRetraction requestRetraction
    */
   public void
   retract(
      MessageRetractionHandle theHandle)
   throws InvalidMessageRetractionHandle,
          TimeRegulationIsNotEnabled,
          MessageCanNoLongerBeRetracted,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.23
   /**
    * Notifies the RTI that future {@link #updateAttributeValues
updateAttributeValues} invocations should use the specified {@link
OrderType}.
    * <p>
    * The attribute ordering types revert to their FDD-specified
values once this federate loses ownership.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @param theType the {@link OrderType} to which
<code>theAttributes</code> should switch
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotOwned if an attribute is not owned by the
federate
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #changeAttributeTransportationType
changeAttributeTransportationType
    * @see #changeInteractionOrderType changeInteractionOrderType
    */
   public void
   changeAttributeOrderType(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      OrderType            theType)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          AttributeNotOwned,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 8.24
   /**
    * Notifies the RTI that future {@link #sendInteraction
sendInteraction} invocations should use the specified {@link
OrderType}.
    * @param theClass the {@link InteractionClassHandle} of the
subject interaction
    * @param theType the {@link OrderType} to which
<code>theClass</code> should switch
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws InteractionClassNotPublished if the federate does not
publish <code>theClass</code>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #changeAttributeOrderType changeAttributeOrderType
    * @see #changeInteractionTransportationType
changeInteractionTransportationType
    */
   public void
   changeInteractionOrderType(
      InteractionClassHandle theClass,
      OrderType              theType)
   throws InteractionClassNotDefined,
          InteractionClassNotPublished,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   //////////////////////////////////
   // Data Distribution Management //
   //////////////////////////////////

   // 9.2
   /**
    * Creates a region template that has the specified dimensions.
    * <p>
    * Before the region can be used for update or subscription, {@link
#setRangeBounds setRangeBounds} must
    * be invoked at least once for each dimension specified. Only then
can {@link #commitRegionModifications commitRegionModifications}
    * be invoked to turn the region template into a region
specification.
    * @param dimensions a {@link DimensionHandleSet} specifying the
region's dimensions
    * @return the {@link RegionHandle} of the newly created region
template
    * @throws InvalidDimensionHandle if one of the {@link
DimensionHandle}s is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #deleteRegion deleteRegion
    */
   public RegionHandle
   createRegion(
      DimensionHandleSet dimensions)
   throws InvalidDimensionHandle,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 9.3
   /**
    * Notifies the RTI that pending dimension range modifications
should be applied to the regions.
    * <p>
    * <code>commitRegionModifications</code> turns region templates
into region specifications and updates region realizations.
    * @param regions a {@link RegionHandleSet} specifying the subject
regions (templates and specifications)
    * @throws InvalidRegion if one of the region templates has not had
all of its ranges set
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #getRangeBounds getRangeBounds
    * @see #setRangeBounds setRangeBounds
    */
   public void
   commitRegionModifications(
      RegionHandleSet regions)
   throws InvalidRegion,
          RegionNotCreatedByThisFederate,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 9.4
   /**
    * Deletes the specified region.
    * <p>
    * Before a region can be deleted, it must be unassociated from any
subscriptions or updates.
    * @param theRegion the {@link RegionHandle} to delete (template or
specification)
    * @throws InvalidRegion if the {@link RegionHandle} is invalid
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws RegionInUseForUpdateOrSubscription if the region is
still in use
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #createRegion createRegion
    */
   public void
   deleteRegion(
      RegionHandle theRegion)
   throws InvalidRegion,
          RegionNotCreatedByThisFederate,
          RegionInUseForUpdateOrSubscription,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   //9.5
   /**
    * Registers a new instance of the specified object class with the
RTI
    * and simultaneously associates its attributes with distribution
regions.
    * @param theClass the {@link ObjectClassHandle} of the object
instance being registered
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions
being simultaneously associated
    * @return the registered object instance's {@link
ObjectInstanceHandle}
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws ObjectClassNotPublished if <code>theClass</code> isn't
published by the federate
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotPublished if an attribute is not published
by the federate
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerObjectInstance registerObjectInstance
    * @see #deleteObjectInstance deleteObjectInstance
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    */
   public ObjectInstanceHandle
   registerObjectInstanceWithRegions(
      ObjectClassHandle             theClass,
      AttributeSetRegionSetPairList attributesAndRegions)
   throws ObjectClassNotDefined,
          ObjectClassNotPublished,
          AttributeNotDefined,
          AttributeNotPublished,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Registers a new instance of the specified object class with the
RTI, using a previously reserved name
    * and simultaneously associates its attributes with distribution
regions.
    * @param theClass the {@link ObjectClassHandle} of the object
instance being registered
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions
being simultaneously associated
    * @param theObject a {@link java.lang.String} holding the
previously reserved object instance name
    * @return the registered object instance's {@link
ObjectInstanceHandle}
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws ObjectClassNotPublished if <code>theClass</code> isn't
published by the federate
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws AttributeNotPublished if an attribute is not published
by the federate
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws ObjectInstanceNameNotReserved if <code>theObject</code>
has not been previously reserved
    * @throws ObjectInstanceNameInUse if <code>theObject</code> is
already in use
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #registerObjectInstance registerObjectInstance
    * @see #reserveObjectInstanceName reserveObjectInstanceName
    * @see #deleteObjectInstance deleteObjectInstance
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    */
```

```
public ObjectInstanceHandle
registerObjectInstanceWithRegions(
   ObjectClassHandle             theClass,
   AttributeSetRegionSetPairList attributesAndRegions,
   String                        theObject)
throws ObjectClassNotDefined,
       ObjectClassNotPublished,
       AttributeNotDefined,
       AttributeNotPublished,
       InvalidRegion,
       RegionNotCreatedByThisFederate,
       InvalidRegionContext,
       ObjectInstanceNameNotReserved,
       ObjectInstanceNameInUse,
       FederateNotExecutionMember,
       SaveInProgress,
       RestoreInProgress,
       RTIinternalError;
   // 9.6
   /**
    * Associates distribution regions with the specified object
instance attributes.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions to
associate
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #unassociateRegionsForUpdates unassociateRegionsForUpdates
    */
   public void
   associateRegionsForUpdates(
      ObjectInstanceHandle          theObject,
      AttributeSetRegionSetPairList attributesAndRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 9.7
   /**
    * Unassociates distribution regions from the specified object
instance attributes.
    * <p>
    * Regions must be unassociated from any distributions and
subscriptions before they can be deleted.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions to
unassociate
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #associateRegionsForUpdates associateRegionsForUpdates
    */
   public void
   unassociateRegionsForUpdates(
      ObjectInstanceHandle          theObject,
      AttributeSetRegionSetPairList attributesAndRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 9.8
   /**
    * Subscribes the federate to certain attributes of an object class
within specified regions.
    * @param theClass the {@link ObjectClassHandle} of the subscribed
object class
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions
being simultaneously associated
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeObjectClassAttributes
subscribeObjectClassAttributes
    * @see #subscribeObjectClassAttributesPassively
subscribeObjectClassAttributesPassively
    * @see #subscribeObjectClassAttributesPassivelyWithRegions
subscribeObjectClassAttributesPassivelyWithRegions
    * @see #unsubscribeObjectClass unsubscribeObjectClass
    * @see #unsubscribeObjectClassAttributes
unsubscribeObjectClassAttributes
    * @see #unsubscribeObjectClassAttributesWithRegions
unsubscribeObjectClassAttributesWithRegions
    */
   public void
   subscribeObjectClassAttributesWithRegions(
      ObjectClassHandle             theClass,
      AttributeSetRegionSetPairList attributesAndRegions)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Subscribes the federate to certain attributes of an object class
within specified regions,
    * without tripping the publishers' object class relevance
advisories.
    * @param theClass the {@link ObjectClassHandle} of the subscribed
object class
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions
being simultaneously associated
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeObjectClassAttributes
subscribeObjectClassAttributes
    * @see #subscribeObjectClassAttributesPassively
subscribeObjectClassAttributesPassively
    * @see #subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions
    * @see #unsubscribeObjectClass unsubscribeObjectClass
    * @see #unsubscribeObjectClassAttributes
unsubscribeObjectClassAttributes
    * @see #unsubscribeObjectClassAttributesWithRegions
unsubscribeObjectClassAttributesWithRegions
    */
   public void
   subscribeObjectClassAttributesPassivelyWithRegions(
      ObjectClassHandle             theClass,
      AttributeSetRegionSetPairList attributesAndRegions)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 9.9
   /**
    * Unsubscribes the federate from certain attributes of an object
class within specified regions.
    * @param theClass the {@link ObjectClassHandle} of the
unsubscribed object class
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions
being simultaneously unassociated
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeObjectClassAttributes
subscribeObjectClassAttributes
    * @see #subscribeObjectClassAttributesPassively
subscribeObjectClassAttributesPassively
    * @see #subscribeObjectClassAttributesWithRegions
subscribeObjectClassAttributesWithRegions
    * @see #subscribeObjectClassAttributesPassivelyWithRegions
subscribeObjectClassAttributesPassivelyWithRegions
    * @see #unsubscribeObjectClass unsubscribeObjectClass
    * @see #unsubscribeObjectClassAttributes
unsubscribeObjectClassAttributes
    */
   public void
   unsubscribeObjectClassAttributesWithRegions(
      ObjectClassHandle             theClass,
      AttributeSetRegionSetPairList attributesAndRegions)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 9.10
   /**
    * Subscribes the federate to an interaction within specified
regions.
    * @param theClass the {@link InteractionClassHandle} of the
subscribed interaction
    * @param regions the {@link RegionHandleSet} describing the
subscription regions
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateServiceInvocationsAreBeingReportedViaMOM if
service invocations are currently being reported via MOM interactions
and <code>theClass</code> is
<code>HLAmanager.HLAfederate.HLAreport.HLAreportServiceInvocation</cod
e>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeInteractionClass subscribeInteractionClass
    * @see #subscribeInteractionClassPassively
subscribeInteractionClassPassively
    * @see #subscribeInteractionClassPassivelyWithRegions
subscribeInteractionClassPassivelyWithRegions
    * @see #unsubscribeInteractionClass unsubscribeInteractionClass
    */
   public void
   subscribeInteractionClassWithRegions(
      InteractionClassHandle theClass,
      RegionHandleSet        regions)
   throws InteractionClassNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateServiceInvocationsAreBeingReportedViaMOM,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Subscribes the federate to an interaction within specified
regions,
    * without tripping the publishers' interaction relevance
advisories.
    * @param theClass the {@link InteractionClassHandle} of the
subscribed interaction
    * @param regions the {@link RegionHandleSet} describing the
subscription regions
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateServiceInvocationsAreBeingReportedViaMOM if
service invocations are currently being reported via MOM interactions
and <code>theClass</code> is
<code>HLAmanager.HLAfederate.HLAreport.HLAreportServiceInvocation</cod
e>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeInteractionClass subscribeInteractionClass
    * @see #subscribeInteractionClassPassively
subscribeInteractionClassPassively
    * @see #subscribeInteractionClassWithRegions
subscribeInteractionClassWithRegions
    * @see #unsubscribeInteractionClass unsubscribeInteractionClass
    */
   public void
   subscribeInteractionClassPassivelyWithRegions(
      InteractionClassHandle theClass,
      RegionHandleSet        regions)
   throws InteractionClassNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateServiceInvocationsAreBeingReportedViaMOM,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 9.11
   /**
    * Unsubscribes the federate from an interaction within specified
regions.
    * @param theClass the {@link InteractionClassHandle} of the
unsubscribed interaction
    * @param regions the {@link RegionHandleSet} describing the
subscription regions
    * @throws InteractionClassNotDefined if <code>theClass</code>
isn't recognized by the RTI
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #subscribeInteractionClassWithRegions
subscribeInteractionClassWithRegions
    */
   public void
   unsubscribeInteractionClassWithRegions(
      InteractionClassHandle theClass,
      RegionHandleSet        regions)
   throws InteractionClassNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   //9.12
   /**
    * Sends an interaction within specified regions.
    * @param theInteraction the {@link InteractionClassHandle} of the
interaction being sent
    * @param theParameters a {@link ParameterHandleValueMap} holding
the interaction values, keyed by parameter
    * @param regions the {@link RegionHandleSet} describing the
distribution regions
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws InteractionClassNotDefined if
<code>theInteraction</code> isn't recognized by the RTI
    * @throws InteractionClassNotPublished if the federate does not
publish <code>theInteraction</code>
    * @throws InteractionParameterNotDefined if one of
<code>theParameters</code> isn't recognized in the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #sendInteraction sendInteraction
    * @see
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,RegionHandleSet)
    */
   public void
   sendInteractionWithRegions(
      InteractionClassHandle  theInteraction,
      ParameterHandleValueMap theParameters,
      RegionHandleSet         regions,
      byte[]                  userSuppliedTag)
   throws InteractionClassNotDefined,
          InteractionClassNotPublished,
          InteractionParameterNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   /**
    * Sends a time-stamped interaction within specified regions.
    * @param theInteraction the {@link InteractionClassHandle} of the
interaction being sent
    * @param theParameters a {@link ParameterHandleValueMap} holding
the interaction values, keyed by parameter
    * @param regions the {@link RegionHandleSet} describing the
distribution regions
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @return the message's {@link MessageRetractionReturn}, should a
retraction become necessary
    * @throws InvalidLogicalTime if the specified
<code>LogicalTime</code> is invalid
    * @throws InteractionClassNotDefined if
<code>theInteraction</code> isn't recognized by the RTI
    * @throws InteractionClassNotPublished if the federate does not
publish <code>theInteraction</code>
    * @throws InteractionParameterNotDefined if one of
<code>theParameters</code> isn't recognized in the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #sendInteraction sendInteraction
    * @see
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderTy
pe,RegionHandleSet)
    * @see #retract retract
    */
```

```
public MessageRetractionReturn
sendInteractionWithRegions(
   InteractionClassHandle  theInteraction,
   ParameterHandleValueMap theParameters,
   RegionHandleSet         regions,
   byte[]                  userSuppliedTag,
   LogicalTime             theTime)
throws InteractionClassNotDefined,
       InteractionClassNotPublished,
       InteractionParameterNotDefined,
       InvalidRegion,
       RegionNotCreatedByThisFederate,
       InvalidRegionContext,
       InvalidLogicalTime,
       FederateNotExecutionMember,
       SaveInProgress,
       RestoreInProgress,
       RTIinternalError;
   // 9.13
   /**
    * Requests that attribute value updates be provided for the
specified instance attributes
    * if they fall within the specified regions.
    * @param theClass the {@link ObjectClassHandle} of the object
class being polled
    * @param attributesAndRegions an {@link
AttributeSetRegionSetPairList} listing the attributes and regions
being polled
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectClassNotDefined if <code>theClass</code> isn't
recognized by the RTI
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws InvalidRegion if the {@link RegionHandle} is invalid or
the region is still a template
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws InvalidRegionContext if the dimensions of one of the
regions are not a subset of the available dimensions of some attribute
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #requestAttributeValueUpdate requestAttributeValueUpdate
    */
   public void
   requestAttributeValueUpdateWithRegions(
      ObjectClassHandle             theClass,
      AttributeSetRegionSetPairList attributesAndRegions,
      byte[]                        userSuppliedTag)
   throws ObjectClassNotDefined,
          AttributeNotDefined,
          InvalidRegion,
          RegionNotCreatedByThisFederate,
          InvalidRegionContext,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   //////////////////////////
   // RTI Support Services //
   //////////////////////////

   // 10.2
   /**
    * Requests the {@link ObjectClassHandle} of the class bearing the
specified name.
    * @param theName a {@link java.lang.String} holding the fully
qualified class name
    * @return the requested {@link ObjectClassHandle}
    * @throws NameNotFound if the name could not be found in the FOM
Document Data
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getKnownObjectClassHandle getKnownObjectClassHandle
    * @see #getObjectClassName getObjectClassName
    */
   public ObjectClassHandle
   getObjectClassHandle(
      String theName)
   throws NameNotFound,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.3
   /**
    * Requests the (fully qualified) name of the object class bearing
the specified {@link ObjectClassHandle}.
    * @param theHandle an {@link ObjectClassHandle}
    * @return the requested class name as a {@link java.lang.String}
    * @throws InvalidObjectClassHandle if the {@link
ObjectClassHandle} was not recognized
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getObjectClassHandle getObjectClassHandle
    */
   public String
   getObjectClassName(
      ObjectClassHandle theHandle)
   throws InvalidObjectClassHandle,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.4
   /**
    * Requests the {@link AttributeHandle} of the specified class'
attribute bearing the specified name.
    * @param whichClass the {@link ObjectClassHandle} of the class to
which the attribute belongs
    * @param theName a {@link java.lang.String} holding the attribute
name
    * @return the requested {@link AttributeHandle}
    * @throws InvalidObjectClassHandle if the {@link
ObjectClassHandle} was not recognized
    * @throws NameNotFound if the name could not be found in the FOM
Document Data
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getAttributeName getAttributeName
    */
   public AttributeHandle
   getAttributeHandle(
      ObjectClassHandle whichClass,
      String            theName)
   throws InvalidObjectClassHandle,
          NameNotFound,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.5
   /**
    * Requests the name of the specified attribute of the specified
class.
    * @param whichClass the {@link ObjectClassHandle} of the class to
which the attribute belongs
    * @param theHandle an {@link AttributeHandle}
    * @return the requested name as a {@link java.lang.String}
    * @throws InvalidObjectClassHandle if the {@link
ObjectClassHandle} was not recognized
    * @throws InvalidAttributeHandle if the {@link AttributeHandle}
was not recognized within the specified context
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getAttributeHandle getAttributeHandle
    */
   public String
   getAttributeName(
      ObjectClassHandle whichClass,
      AttributeHandle   theHandle)
   throws InvalidObjectClassHandle,
          InvalidAttributeHandle,
          AttributeNotDefined,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.6
   /**
    * Requests the {@link InteractionClassHandle} bearing the
specified (fully qualified) name.
    * @param theName a {@link java.lang.String} holding the
interaction class name
    * @return the requested {@link InteractionClassHandle}
    * @throws NameNotFound if the name could not be found in the FOM
Document Data
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getInteractionClassName getInteractionClassName
    */
   public InteractionClassHandle
   getInteractionClassHandle(
      String theName)
   throws NameNotFound,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.7
   /**
    * Requests the (fully qualified) name of the specified interaction
class.
    * @param theHandle the {@link InteractionClassHandle}
    * @return the requested name as a {@link java.lang.String}
    * @throws InvalidInteractionClassHandle if the {@link
InteractionClassHandle} was not recognized
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getInteractionClassHandle getInteractionClassHandle
    */
   public String
   getInteractionClassName(
      InteractionClassHandle theHandle)
   throws InvalidInteractionClassHandle,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.8
   /**
    * Requests the {@link ParameterHandle} of the interaction class'
parameter bearing the specified (fully qualified) name.
    * @param whichClass the {@link InteractionClassHandle} to which
the parameter belongs
    * @param theName a {@link java.lang.String} holding the name of
the parameter
    * @return the requested {@link ParameterHandle}
    * @throws InvalidInteractionClassHandle if the {@link
InteractionClassHandle} was not recognized
    * @throws NameNotFound if the name could not be found in the FOM
Document Data
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getParameterName getParameterName
    */
   public ParameterHandle
   getParameterHandle(
      InteractionClassHandle whichClass,
      String                 theName)
   throws InvalidInteractionClassHandle,
          NameNotFound,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.9
   /**
    * Requests the name of the interaction class' parameter bearing
the specified {@link ParameterHandle}.
    * @param whichClass the {@link InteractionClassHandle} to which
the parameter belongs
    * @param theHandle the parameter's {@link ParameterHandle}
    * @return the requested name as a {@link java.lang.String}
    * @throws InvalidInteractionClassHandle if the {@link
InteractionClassHandle} was not recognized
    * @throws InvalidParameterHandle if the {@link ParameterHandle}
was not recognized within the specified context
    * @throws InteractionParameterNotDefined if <code>theHandle</code>
isn't recognized in the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getParameterHandle getParameterHandle
    */
   public String
   getParameterName(
      InteractionClassHandle whichClass,
      ParameterHandle        theHandle)
   throws InvalidInteractionClassHandle,
          InvalidParameterHandle,
          InteractionParameterNotDefined,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.10
   /**
    * Requests the {@link ObjectInstanceHandle} of the object instance
bearing the specified name.
    * @param theName a {@link java.lang.String} holding the name of
the object instance
    * @return the requested {@link ObjectInstanceHandle}
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getObjectInstanceName getObjectInstanceName
    */
   public ObjectInstanceHandle
   getObjectInstanceHandle(
      String theName)
   throws ObjectInstanceNotKnown,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.11
   /**
    * Requests the name of the object instance bearing the specified
{@link ObjectInstanceHandle}.
    * @param theHandle the {@link ObjectInstanceHandle} of the object
instance
    * @return the requested name as a {@link java.lang.String}
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getObjectInstanceHandle getObjectInstanceHandle
    */
   public String
   getObjectInstanceName(
      ObjectInstanceHandle theHandle)
   throws ObjectInstanceNotKnown,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.12
   /**
    * Requests the {@link DimensionHandle} of the dimension bearing
the specified name.
    * @param theName a {@link java.lang.String} holding the name of
the dimension
    * @return the requested {@link DimensionHandle}
    * @throws NameNotFound if the name could not be found in the FOM
Document Data
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getDimensionName getDimensionName
    */
   public DimensionHandle
   getDimensionHandle(
      String theName)
   throws NameNotFound,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.13
   /**
    * Requests the name of the dimension bearing the specified {@link
DimensionHandle}.
    * @param theHandle the {@link DimensionHandle} of the dimension
    * @return the requested name as a {@link java.lang.String}
    * @throws InvalidDimensionHandle if one of the {@link
DimensionHandle}s is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getDimensionHandle getDimensionHandle
    */
   public String
   getDimensionName(
      DimensionHandle theHandle)
   throws InvalidDimensionHandle,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.14
   /**
    * Requests the upper bound of the specified dimension. All
dimensions have zero as their lower bound.
    * @param theHandle the {@link DimensionHandle} of the dimension
    * @return the requested upper bound as a <code>long</code>
    * @throws InvalidDimensionHandle if one of the {@link
DimensionHandle}s is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    */
   public long
   getDimensionUpperBound(
      DimensionHandle theHandle)
   throws InvalidDimensionHandle,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.15
   /**
    * Requests the available dimensions of the specified class
attribute.
    * @param whichClass the {@link ObjectClassHandle}
    * @param theHandle the {@link AttributeHandle}
    * @return the requested {@link DimensionHandleSet}
    * @throws InvalidObjectClassHandle if the {@link
ObjectClassHandle} was not recognized
    * @throws InvalidAttributeHandle if the {@link AttributeHandle}
was not recognized within the specified context
    * @throws AttributeNotDefined if an attribute could not be
recognized within the supplied context
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    */
   public DimensionHandleSet
   getAvailableDimensionsForClassAttribute(
      ObjectClassHandle whichClass,
      AttributeHandle   theHandle)
   throws InvalidObjectClassHandle,
          InvalidAttributeHandle,
          AttributeNotDefined,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.16
   /**
    * Requests the {@link ObjectClassHandle} of the class the
specified object instance is known under.
    * @param theObject the {@link ObjectInstanceHandle} of the object
instance
    * @return the requested {@link ObjectClassHandle}
    * @throws ObjectInstanceNotKnown if the RTI considers that the
federate has not discovered <code>theObject</code>
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getObjectClassHandle getObjectClassHandle
    * @see #getObjectClassName getObjectClassName
    */
   public ObjectClassHandle
   getKnownObjectClassHandle(
      ObjectInstanceHandle theObject)
   throws ObjectInstanceNotKnown,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.17
   /**
    * Requests the available dimensions of the specified interaction.
    * @param theHandle the {@link InteractionClassHandle}
    * @return the requested {@link DimensionHandleSet}
    * @throws InvalidInteractionClassHandle if the {@link
InteractionClassHandle} was not recognized
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    */
   public DimensionHandleSet
   getAvailableDimensionsForInteractionClass(
      InteractionClassHandle theHandle)
   throws InvalidInteractionClassHandle,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.18
   /**
    * Requests the {@link TransportationType} bearing the specified
name, as defined in the FDD Transportation Table.
    * @param theName a {@link java.lang.String} holding the
transportation type's name
    * @return the requested {@link TransportationType}
    * @throws InvalidTransportationName if the name is not recognized
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getTransportationName getTransportationName
    */
   public TransportationType
   getTransportationType(
      String theName)
   throws InvalidTransportationName,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.19
   /**
    * Requests the name of the specified {@link TransportationType},
as defined in the FDD Transportation Table.
    * @param theType the {@link TransportationType} for which to
return the name
    * @return the requested name as a {@link java.lang.String}
    * @throws InvalidTransportationType if the {@link
TransportationType} is not recognized
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getTransportationType getTransportationType
    */
   public String
   getTransportationName(
      TransportationType theType)
   throws InvalidTransportationType,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.20
   /**
    * Requests the {@link OrderType} bearing the specified name, as
defined in the IEEE 1516 specification.
    * @param theName a {@link java.lang.String} holding the ordering
type's name
    * @return the requested {@link OrderType}
    * @throws InvalidOrderName if the name is not recognized
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getOrderName getOrderName
    */
   public OrderType
   getOrderType(
      String theName)
   throws InvalidOrderName,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.21
   /**
    * Requests the name of the specified {@link OrderType}, as defined
in the IEEE 1516 specification.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 changes the parameter
from "theHandle" to "theType".
    * @param theType the {@link OrderType} for which to return the
name
    * @return the requested name as a {@link java.lang.String}
    * @throws InvalidOrderType if the {@link OrderType} is not
recognized
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #getOrderType getOrderType
    */
   public String
   getOrderName(
      OrderType theType)
   throws InvalidOrderType,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.22
   /**
    * Turns the object class relevance advisory switch on for the
federate.
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws ObjectClassRelevanceAdvisorySwitchIsOn if the advisory
switch is already on
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableObjectClassRelevanceAdvisorySwitch
disableObjectClassRelevanceAdvisorySwitch
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    */
   public void
   enableObjectClassRelevanceAdvisorySwitch()
   throws FederateNotExecutionMember,
          ObjectClassRelevanceAdvisorySwitchIsOn,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 10.23
   /**
    * Turns the object class relevance advisory switch off for the
federate.
    * @throws ObjectClassRelevanceAdvisorySwitchIsOff if the advisory
switch is already off
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableObjectClassRelevanceAdvisorySwitch
enableObjectClassRelevanceAdvisorySwitch
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    */
   public void
   disableObjectClassRelevanceAdvisorySwitch()
   throws ObjectClassRelevanceAdvisorySwitchIsOff,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 10.24
   /**
    * Turns the attribute relevance advisory switch on for the
federate.
    * @throws AttributeRelevanceAdvisorySwitchIsOn if the advisory
switch is already on
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableAttributeRelevanceAdvisorySwitch
disableAttributeRelevanceAdvisorySwitch
    */
   public void
   enableAttributeRelevanceAdvisorySwitch()
   throws AttributeRelevanceAdvisorySwitchIsOn,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 10.25
   /**
    * Turns the attribute relevance advisory switch off for the
federate.
    * @throws AttributeRelevanceAdvisorySwitchIsOff if the advisory
switch is already off
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableAttributeRelevanceAdvisorySwitch
enableAttributeRelevanceAdvisorySwitch
    */
   public void
   disableAttributeRelevanceAdvisorySwitch()
   throws AttributeRelevanceAdvisorySwitchIsOff,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 10.26
   /**
    * Turns the attribute scope advisory switch on for the federate.
    * @throws AttributeScopeAdvisorySwitchIsOn if the advisory switch
is already on
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableAttributeScopeAdvisorySwitch
disableAttributeScopeAdvisorySwitch
    * @see FederateAmbassador#attributesOutOfScope
attributesOutOfScope
    * @see FederateAmbassador#attributesInScope attributesInScope
    */
   public void
   enableAttributeScopeAdvisorySwitch()
   throws AttributeScopeAdvisorySwitchIsOn,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 10.27
   /**
    * Turns the attribute scope advisory switch off for the federate.
    * @throws AttributeScopeAdvisorySwitchIsOff if the advisory switch
is already off
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableAttributeScopeAdvisorySwitch
enableAttributeScopeAdvisorySwitch
    * @see FederateAmbassador#attributesOutOfScope
attributesOutOfScope
    * @see FederateAmbassador#attributesInScope attributesInScope
    */
   public void
   disableAttributeScopeAdvisorySwitch()
   throws AttributeScopeAdvisorySwitchIsOff,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 10.28
   /**
    * Turns the interaction relevance advisory switch on for the
federate.
    * @throws InteractionRelevanceAdvisorySwitchIsOn if the advisory
switch is already on
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableInteractionRelevanceAdvisorySwitch
disableInteractionRelevanceAdvisorySwitch
    * @see FederateAmbassador#turnInteractionsOn turnInteractionsOn
    * @see FederateAmbassador#turnInteractionsOff turnInteractionsOff
    */
   public void
   enableInteractionRelevanceAdvisorySwitch()
   throws InteractionRelevanceAdvisorySwitchIsOn,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 10.29
   /**
    * Turns the interaction relevance advisory switch off for the
federate.
    * @throws InteractionRelevanceAdvisorySwitchIsOff if the advisory
switch is already off
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableInteractionRelevanceAdvisorySwitch
enableInteractionRelevanceAdvisorySwitch
    * @see FederateAmbassador#turnInteractionsOn turnInteractionsOn
    * @see FederateAmbassador#turnInteractionsOff turnInteractionsOff
    */
   public void
   disableInteractionRelevanceAdvisorySwitch()
   throws InteractionRelevanceAdvisorySwitchIsOff,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 10.30
   /**
    * Requests the {@link DimensionHandleSet} of the specified region.
    * The specified region must either have been {@link #createRegion
created} by the invoking federate
    * or conveyed to it in a {@link RegionHandleSet} callback
argument.
    * @param region the {@link RegionHandle} of the region template,
specification, or realization
    * @return A {@link DimensionHandleSet} specifying the dimensions
of the region
    * @throws InvalidRegion if the {@link RegionHandle} is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see
FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,Attribu
teHandleValueMap,byte[],OrderType,TransportationType,RegionHandleSet)
    * @see
FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,Attribu
teHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,Order
Type,RegionHandleSet)
    * @see
FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,Attribu
teHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,Order
Type,MessageRetractionHandle,RegionHandleSet)
    * @see
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,RegionHandleSet)
    * @see
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderTy
pe,RegionHandleSet)
    * @see
FederateAmbassador#receiveInteraction(InteractionClassHandle,Parameter
HandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderTy
pe,MessageRetractionHandle,RegionHandleSet)
    */
   public DimensionHandleSet
   getDimensionHandleSet(
      RegionHandle region)
   throws InvalidRegion,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 10.31
   /**
    * Requests the {@link RangeBounds} of the specified dimension of
the specified region specification or realization.
    * This service may not be invoked on region templates.
    * @param region the {@link RegionHandle} of the region template or
specification
    * @param dimension the {@link DimensionHandle} of the dimension
    * @return the requested {@link RangeBounds}
    * @throws InvalidRegion if the {@link RegionHandle} is invalid
    * @throws RegionDoesNotContainSpecifiedDimension if the specified
region does not contain the specified dimension
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #setRangeBounds setRangeBounds
    * @see #commitRegionModifications commitRegionModifications
    */
   public RangeBounds
   getRangeBounds(
      RegionHandle    region,
      DimensionHandle dimension)
   throws InvalidRegion,
          RegionDoesNotContainSpecifiedDimension,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 10.32
   /**
    * Sets the {@link RangeBounds} of the specified dimension of the
specified region.
    * @param region the {@link RegionHandle} of the region template or
specification
    * @param dimension the {@link DimensionHandle} of the dimension
    * @param bounds the {@link RangeBounds} to set
    * @throws InvalidRegion if the {@link RegionHandle} is invalid
    * @throws RegionNotCreatedByThisFederate if the federate does not
own (did not create) one of the regions in the set
    * @throws RegionDoesNotContainSpecifiedDimension if the specified
region does not contain the specified dimension
    * @throws InvalidRangeBound if the {@link RangeBounds} is invalid
(the lower bound is smaller than the upper)
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #getRangeBounds getRangeBounds
    * @see #commitRegionModifications commitRegionModifications
    */
   public void
   setRangeBounds(
      RegionHandle    region,
      DimensionHandle dimension,
      RangeBounds     bounds)
   throws InvalidRegion,
          RegionNotCreatedByThisFederate,
          RegionDoesNotContainSpecifiedDimension,
          InvalidRangeBound,
          FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   // 10.33
   /**
    * Projects a {@link FederateHandle} onto the
<code>Federates</code> dimension
    * (defined by the Management Object Model(MOM)) for
<code>Region</code> specification purposes.
    * @param federateHandle the <code>FederateHandle</code> to project
onto the <code>Federates</code> dimension
    * @return a <code>long</code> representing the federate's co-
ordinate along the <code>Federates</code> dimension
    * @throws InvalidFederateHandle if the specified federate handle
is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    */
   public long
   normalizeFederateHandle(
      FederateHandle federateHandle)
   throws InvalidFederateHandle,
          FederateNotExecutionMember,
          RTIinternalError;

   // 10.34
   /**
    * Projects a {@link ServiceGroup} onto the
<code>ServiceGroups</code> dimension
    * (defined by the Management Object Model(MOM)) for
<code>Region</code> specification purposes.
    * <p>
    * The <code>ServiceGroup</code> class uses privately the values 4
through 10 whereas the Management Object Model uses 0 through 6.
    * <code>normalizeServiceGroup</code> handles the translation.
    * <p>
    * The <code>InvalidServiceGroup</code> exception was missing from
Annex B (but not from the 10.34 clause).
    * @param group the <code>ServiceGroup</code> to project onto the
<code>ServiceGroups</code> dimension
    * @return a <code>long</code> representing the group's co-ordinate
along the <code>ServiceGroups</code> dimension
    * @throws InvalidServiceGroup if the specified service group
designator is invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    */
   public long
   normalizeServiceGroup(
      ServiceGroup group)
   throws InvalidServiceGroup,
          FederateNotExecutionMember,
          RTIinternalError;
   // 10.35
   /**
    * In the DoD Interpretations of IEEE 1516-2000v2, this service is
deleted,
    * along with the InitializePreviouslyInvoked exception (which it
was the only one to throw).
    * @throws RTIinternalError if something else goes wrong
    */
   //public java.util.Properties
   //initializeRTI(
//      java.util.Properties properties)
   //throws InitializePreviouslyInvoked,
//          BadInitializationParameter,
//          RTIinternalError;

   // 10.36
   /**
    * In the DoD Interpretations of IEEE 1516-2000v2, this service is
deleted,
    * along with the InitializeNeverInvoked and
SomeFederateJoinedToAnExecution exceptions (which it was the only one
to throw).
    * @throws RTIinternalError if something else goes wrong
    */
   //public void
   //finalizeRTI()
   //throws InitializeNeverInvoked,
//          SomeFederateJoinedToAnExecution,
//          RTIinternalError;

   // 10.37
   /**
    * Requests that the RTI invoke a single federate callback or, if
there are none pending, that
    * the method time out after the specified real time has elapsed.
    * <p>
    * If callbacks are disabled, the method times out after the
specified real-time interval has
    * elapsed but nevertheless returns <code>true</code> even though
no callbacks are invoked.
    * @param seconds A <code>double</code> specifying the time out in
real-time seconds (with a precision of at least 1 ms)
    * @return <code>true</code> iff there was at least one callback
pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #evokeMultipleCallbacks evokeMultipleCallbacks
    * @see #enableCallbacks enableCallbacks
    * @see #disableCallbacks disableCallbacks
    */
   public boolean
   evokeCallback(
      double seconds)
   throws FederateNotExecutionMember,
          RTIinternalError;
   // 10.38
   /**
    * Requests that the RTI invoke federate callbacks or wait until a
minimum real time has elapsed
    * and continue doing so until either it runs out of callbacks or a
maximum real time is reached.
    * <p>
    * This method will wait for at least the <code>minimumTime</code>,
invoking callbacks (if any) during
    * that real-time interval. Once that interval has elapsed, it
returns when it runs out of callbacks
    * or after <code>maximumTime</code> has elapsed, whichever occurs
first.
    * <p>
    * If callbacks are disabled, the method times out after the
specified maximum real-time interval has
    * elapsed but nevertheless returns <code>true</code> even though
no callbacks are invoked.
    * @param minimumTime A <code>double</code> specifying the minimum
real-time to wait for, in seconds (with a precision of at least 1 ms)
    * @param maximumTime A <code>double</code> specifying the maximum
real-time to wait for, in seconds (with a precision of at least 1 ms)
    * @return <code>true</code> iff there was at least one callback
pending
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong
    * @see #evokeCallback evokeCallback
    * @see #enableCallbacks enableCallbacks
    * @see #disableCallbacks disableCallbacks
    */
   public boolean
   evokeMultipleCallbacks(
      double minimumTime,
      double maximumTime)
   throws FederateNotExecutionMember,
          RTIinternalError;
   // 10.39
   /**
    * Instructs the RTI to deliver callbacks when the {@link
#evokeCallback evokeCallback} and
    * {@link #evokeMultipleCallbacks evokeMultipleCallbacks} methods
are invoked. This is the default federate state.
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #disableCallbacks disableCallbacks
    * @see #evokeCallback evokeCallback
    * @see #evokeMultipleCallbacks evokeMultipleCallbacks
    */
   public void
   enableCallbacks()
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;

   // 10.40
   /**
    * Instructs the RTI to withold callbacks when the {@link
#evokeCallback evokeCallback} and
    * {@link #evokeMultipleCallbacks evokeMultipleCallbacks} methods
are invoked. These methods then time out
    * as instructed but nevertheless return <code>true</code> to
indicate callbacks are pending.
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws SaveInProgress if the federate is in one of the save-in-
progress states
    * @throws RestoreInProgress if the federate is in one of the
restore-in-progress states
    * @throws RTIinternalError if something else goes wrong
    * @see #enableCallbacks enableCallbacks
    * @see #evokeCallback evokeCallback
    * @see #evokeMultipleCallbacks evokeMultipleCallbacks
    */
   public void
   disableCallbacks()
   throws FederateNotExecutionMember,
          SaveInProgress,
          RestoreInProgress,
          RTIinternalError;
   //API-specific services
   /**
    * Supplies the RTIambassador's {@link AttributeHandleFactory},
which can be used to
    * decode callback arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link AttributeHandleFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public AttributeHandleFactory
   getAttributeHandleFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link AttributeHandleSetFactory},
which can be used to
    * prepare method arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return the RTIambassador's {@link AttributeHandleSetFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public AttributeHandleSetFactory
   getAttributeHandleSetFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link
AttributeHandleValueMapFactory}, which can be used to
    * prepare method arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link
AttributeHandleValueMapFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public AttributeHandleValueMapFactory
   getAttributeHandleValueMapFactory()
   throws FederateNotExecutionMember;
   /**
    * Supplies the RTIambassador's {@link
AttributeSetRegionSetPairListFactory}, which can be used to
    * prepare method arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link
AttributeSetRegionSetPairListFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public AttributeSetRegionSetPairListFactory
   getAttributeSetRegionSetPairListFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link DimensionHandleFactory},
which can be used to
    * decode callback arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link DimensionHandleFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public DimensionHandleFactory
   getDimensionHandleFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link DimensionHandleSetFactory},
which can be used to
    * prepare method arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link DimensionHandleSetFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public DimensionHandleSetFactory
   getDimensionHandleSetFactory()
   throws FederateNotExecutionMember;
   /**
    * Supplies the RTIambassador's {@link FederateHandleFactory},
which can be used to
    * decode callback arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link FederateHandleFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public FederateHandleFactory
   getFederateHandleFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link FederateHandleSetFactory},
which can be used to
    * prepare method arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link FederateHandleSetFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public FederateHandleSetFactory
   getFederateHandleSetFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link
InteractionClassHandleFactory}, which can be used to
    * decode callback arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link
InteractionClassHandleFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public InteractionClassHandleFactory
   getInteractionClassHandleFactory()
   throws FederateNotExecutionMember;
   /**
    * Supplies the RTIambassador's {@link ObjectClassHandleFactory},
which can be used to
    * decode callback arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link ObjectClassHandleFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public ObjectClassHandleFactory
   getObjectClassHandleFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link
ObjectInstanceHandleFactory}, which can be used to
    * decode callback arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link ObjectInstanceHandleFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public ObjectInstanceHandleFactory
   getObjectInstanceHandleFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link ParameterHandleFactory},
which can be used to
    * decode callback arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link ParameterHandleFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public ParameterHandleFactory
   getParameterHandleFactory()
   throws FederateNotExecutionMember;
   /**
    * Supplies the RTIambassador's {@link
ParameterHandleValueMapFactory}, which can be used to
    * prepare method arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link
ParameterHandleValueMapFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public ParameterHandleValueMapFactory
   getParameterHandleValueMapFactory()
   throws FederateNotExecutionMember;

   /**
    * Supplies the RTIambassador's {@link RegionHandleSetFactory},
which can be used to
    * prepare method arguments.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 added "throws
FederateNotExecutionMember"
    * to each of the get*Factory services.
    * @return The RTIambassador's {@link RegionHandleSetFactory}
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    */
   public RegionHandleSetFactory
   getRegionHandleSetFactory()
   throws FederateNotExecutionMember;

   /**
    * Identifies the RTI's version.
    * @return The {@link java.lang.String} "1516.1.5"
    */
   public String
   getHLAversion();
}
//end RTIambassador
```

```
// File: SaveFailureReason.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the reason why the save operation of a federate
failed.
 * It is reported by the {@link FederateAmbassador#federationNotSaved
federationNotSaved} callback.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see hla.rti1516.FederateAmbassador#federationNotSaved
federationNotSaved
 */
public final class
SaveFailureReason
   implements java.io.Serializable
{
   //each instance's value
   private int _value;
   //initial value for enumeration
   private static final int _lowestValue = 1;
   //begins at lowest
   private static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of a SaveFailureReason must be
initialized with one of the defined static values.
    * @param otherSaveFailureReasonValue must be a defined static
value or another instance.
    */
   public SaveFailureReason(SaveFailureReason
otherSaveFailureReasonValue)
   {
      _value = otherSaveFailureReasonValue._value;
   }

   /**
    * Package-only (default access) constructor. Unused.
    * @param value to assign to the instance; must be one of the
static ones
    */
   SaveFailureReason(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("SaveFailureReason: illegal value
" + value);
   }
   /**
    * Private constructor; it is used to generate the static values.
    */
   private
   SaveFailureReason()
   {
      _value = _nextToAssign++;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>SaveFailureReason</code>.
    * @return A {@link java.lang.String} with value
"SaveFailureReason(n)" where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "SaveFailureReason(" + _value + ")";
   }

   /**
    * Returns true iff <code>this</code> and
<code>otherSaveFailureReasonValue</code> represent the same save
failure reason.
    * @param otherSaveFailureReasonValue The <code>Object</code> to
compare with
    * @return true iff supplied
<code>otherSaveFailureReasonValue</code> is of type
<code>SaveFailureReason</code> and has same value
    */
   public boolean
   equals(Object otherSaveFailureReasonValue)
   {
      if (otherSaveFailureReasonValue instanceof SaveFailureReason)
         return _value ==
((SaveFailureReason)otherSaveFailureReasonValue)._value;
      else
         return false;
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>SaveFailureReason</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }
   //The constant instances
   /**
    * The RTI was unable to save.
    */
   static public final SaveFailureReason
   RTI_UNABLE_TO_SAVE = new SaveFailureReason();

   /**
    * One or more joined federates have invoked the {@link
RTIambassador#federateSaveNotComplete federateSaveNotComplete} method.
    */
   static public final SaveFailureReason
   FEDERATE_REPORTED_FAILURE = new SaveFailureReason();

   /**
    * One or more joined federates have resigned from the federation
execution.
    */
   static public final SaveFailureReason
   FEDERATE_RESIGNED = new SaveFailureReason();

   /**
    * The RTI has detected failure at one or more of the joined
federates.
    */
   static public final SaveFailureReason
   RTI_DETECTED_FAILURE = new SaveFailureReason();

   /**
    * The time stamp specified by the (4.11) {@link
RTIambassador#requestFederationSave(String,LogicalTime)}
    * request cannot be honored, due to possible race conditions in
the distributed calculation of GALT (Greatest Available Logical Time).
    */
   static public final SaveFailureReason
   SAVE_TIME_CANNOT_BE_HONORED = new SaveFailureReason();
}
//end SaveFailureReason
```

```
// File: SaveStatus.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the save status of a federate during a federation save
operation.
 * It is contained in the {@link FederateHandleSaveStatusPair}
argument of the {@link FederateAmbassador#federationSaveStatusResponse
federationSaveStatusResponse} callback.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
SaveStatus
   implements java.io.Serializable
{
   //each instance's value
   private int _value;
   //initial value for enumeration
   private static final int _lowestValue = 1;
   //begins at lowest
   private static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of a <code>SaveStatus</code> must be
initialized with one of the defined static values.
    * @param otherSaveStatusValue must be a defined static value or
another instance.
    */
   public
   SaveStatus(SaveStatus otherSaveStatusValue)
   {
      _value = otherSaveStatusValue._value;
   }

   /**
    * Package-only (default access) constructor. Unused.
    * @param value to assign to the instance; must be one of the
static ones
    */
   SaveStatus(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("SaveStatus: illegal value " +
value);
   }
   /**
    * Private constructor; it is used to generate the static values.
    */
   private
   SaveStatus()
   {
      _value = _nextToAssign++;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>SaveStatus</code>.
    * @return A {@link java.lang.String} with value "SaveStatus(n)"
where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "SaveStatus(" + _value + ")";
   }

   /**
    * Returns true iff <code>this</code> and
<code>otherSaveStatusValue</code> represent the same save status.
    * @param otherSaveStatusValue The <code>Object</code> to compare
with
    * @return true iff supplied <code>other</code> is of type
<code>SaveStatus</code> and has same value
    */
   public boolean
   equals(Object otherSaveStatusValue)
   {
      if (otherSaveStatusValue instanceof SaveStatus)
         return _value == ((SaveStatus)otherSaveStatusValue)._value;
      else
         return false;
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>SaveStatus</code>es for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }
   //The constant instances
   /**
    * No save in progress (federate in Active or Restore Request
Pending states).
    */
   static public final SaveStatus
   NO_SAVE_IN_PROGRESS = new SaveStatus();

   /**
    * Federate in the Instructed To Save state.
    */
   static public final SaveStatus
   FEDERATE_INSTRUCTED_TO_SAVE = new SaveStatus();

   /**
    * Federate in the Saving state.
    */
   static public final SaveStatus
   FEDERATE_SAVING = new SaveStatus();

   /**
    * Federate in the Waiting For Federation To Save state.
    */
   static public final SaveStatus
   FEDERATE_WAITING_FOR_FEDERATION_TO_SAVE = new SaveStatus();
}
//end SaveStatus
```

```
// File: ServiceGroup.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the seven HLA service groups (Federation management;
Declaration management;
 * Object management; Ownership management; Time management;
 * Data distribution management; and Support services).
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 changes one of the constant
names from "SUPPPORT_SERVICES" to "SUPPORT_SERVICES".
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 * @see hla.rti1516.RTIambassador#normalizeServiceGroup
normalizeServiceGroup
 */
public final class
ServiceGroup
   implements java.io.Serializable
{
   //each instance's value
   private int _value;
   //initial value for enumeration: fedn mgt is chapter 4
   private static final int _lowestValue = 4;  //_lowestValue = 0 may
be more compatible with the MOM
   //begins at lowest
   private static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of a <code>ServiceGroup</code> must
be initialized with one of the defined static values.
    * @param otherServiceGroupValue must be a defined static value or
another instance.
    */
   public
   ServiceGroup(ServiceGroup otherServiceGroupValue)
   {
      _value = otherServiceGroupValue._value;
   }

   /**
    * Package-only (default access) constructor. Unused.
    * @param value to assign to the instance; must be one of the
static ones
    */
   ServiceGroup(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("ServiceGroup: illegal value " +
value);
   }
   /**
    * Private constructor; it is used to generate the static values.
    */
   private
   ServiceGroup()
   {
      _value = _nextToAssign++;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>ServiceGroup</code>.
    * @return A {@link java.lang.String} with value "ServiceGroup(n)"
where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "ServiceGroup(" + _value + ")";
   }

   /**
    * Returns true iff <code>this</code> and
<code>otherServiceGroupValue</code> represent the same service group.
    * @param otherServiceGroupValue The <code>Object</code> to compare
with
    * @return true iff supplied <code>otherServiceGroupValue</code> is
of type <code>ServiceGroup</code> and has same value
    */
   public boolean
   equals(Object otherServiceGroupValue)
   {
      if (otherServiceGroupValue instanceof ServiceGroup)
         return _value ==
((ServiceGroup)otherServiceGroupValue)._value;
      else
         return false;
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>ServiceGroup</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }
   //The constant instances
   /**
    * Methods and callbacks referring to the creation, dynamic
control, modification and deletion of a federation execution.
    */
   static public final ServiceGroup
   FEDERATION_MANAGEMENT = new ServiceGroup();

   /**
    * Methods and callbacks dealing with the intent of federates to
generate or consume information.
    */
   static public final ServiceGroup
   DECLARATION_MANAGEMENT = new ServiceGroup();

   /**
    * Methods and callbacks dealing with the registration,
modification and deletion of object instances,
    * as well as the sending and receipt of interactions.
    */
   static public final ServiceGroup
   OBJECT_MANAGEMENT = new ServiceGroup();

   /**
    * Methods and callbacks dealing with the ownership of instance
attributes among joined federates.
    * The ability to transfer ownership of instance attributes among
joined federates supports the
    * cooperative modeling of object instances across a federation.
    */
   static public final ServiceGroup
   OWNERSHIP_MANAGEMENT = new ServiceGroup();

   /**
    * Methods and callbacks dealing with the ordering of the delivery
of messages throughout the federation execution.
    * Use of these mechanisms permits messages sent by different
joined federates to be delivered in a consistent
    * order to any joined federate in the federation execution that is
to receive those messages.
    */
   static public final ServiceGroup
   TIME_MANAGEMENT = new ServiceGroup();

   /**
    * Methods and callbacks dealing with the reduction in the
transmission and reception of
    * irrelevant data. Whereas DECLARATION_MANAGEMENT services provide
information on data relevance
    * at the class attribute and interaction class levels,
DATA_DISTRIBUTION_MANAGEMENT services add
    * the capability to further refine the data requirements at the
instance attribute and specific
    * interaction levels.
    */
   static public final ServiceGroup
   DATA_DISTRIBUTION_MANAGEMENT = new ServiceGroup();
   /**
    * Miscellaneous services utilized by joined federates for
performing such actions as
    * name-to-handle and handle-to-name transformation, setting
advisory switches and
    * manipulating regions.
    */
   static public final ServiceGroup
   SUPPORT_SERVICES = new ServiceGroup();
}
//end ServiceGroup
```

```
// File: TimeQueryReturn.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Record returned by (8.16) {@link RTIambassador#queryGALT queryGALT}
and (8.18) {@link RTIambassador#queryLITS queryLITS}.
 * It consists of a guard boolean (<code>timeIsValid</code>) and a
payload {@link LogicalTime} (<code>time</code>).
 * <p>
 * DoD Interpretations of IEEE 1516-2000v2 adds the
java.io.Serializable implementation and a constructor.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
TimeQueryReturn
   implements java.io.Serializable
{
   /**
    * Whether the other field is valid or not.
    */
   public boolean
   timeIsValid;

   /**
    * Payload Logical Time.
    */
   public LogicalTime
   time;

   /**
    * Public constructor.
    * @param tiv Whether the {@link LogicalTime} field is valid or not
    * @param lt The <code>LogicalTime</code> field
    */
   public
   TimeQueryReturn(boolean     tiv,
                   LogicalTime lt)
   {
      timeIsValid = tiv;
      time = lt;
   }

   /**
    * Returns a <code>String</code> representation of the
<code>TimeQueryReturn</code>.
    * @return A {@link java.lang.String} with value
"&lt;timeIsValid&gt; &lt;time&gt;"
    */
   public String
   toString()
   {
      return "" + timeIsValid + " " + time;
   }
   /**
    * Returns true iff <code>this</code> and <code>other</code>
represent the same time query return.
    * @param other The <code>Object</code> to compare with
    * @return true iff supplied <code>other</code> is of type
<code>TimeQueryReturn</code> and has same value
    */
   public boolean
   equals(Object other)
   {
      if (other instanceof TimeQueryReturn)
      {
         TimeQueryReturn tqrOther = (TimeQueryReturn)other;
         if ((timeIsValid == false) && (tqrOther.timeIsValid ==
false))
         {
            //When timeIsValid is false, the payloads are ignored
            return true;
         }
         else if ((timeIsValid == true) && (tqrOther.timeIsValid ==
true))
         {
            //When timeIsValid is true, the payloads must match
            return time.equals(tqrOther.time);
         }
         else
         {
            //mismatched timeIsValid fields
            return false;
         }
      }
      else
      {
         //Not the same classes
         return false;
      }
   }

   /**
    * Returns a hash code for <code>this</code>; two
<code>TimeQueryReturn</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return (timeIsValid ? time.hashCode() : 7);
   }
}
//end TimeQueryReturn
```

```
// File: TransportationType.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * An enumerated type (not a Java {@link java.util.Enumeration}!)
 * representing the RTI-provided means of message transmission between
joined federates.
 * Transportation Type defaults are defined at the attribute and
parameter level by the FOM Document Data; these may be overridden by
their owners.
 * The two core TransportationTypes are:
 * <ul>
 * <li><code>HLAreliable</code>: provides reliable delivery of data in
the sense that TCP/IP delivers its data reliably
 * <li><code>HLAbestEffort</code>: makes an effort to deliver data in
the sense that UDP provides best-effort delivery
* </ul>
 * Additional <code>TransportationType</code>s may be provided by
specific RTIs.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public class
TransportationType
   implements java.io.Serializable
{
   /**
    * Each instance's value.
    */
   protected int _value;

   //initial value for enumeration
   private static final int _lowestValue = 1;

   /**
    * The enumeration begins at the lowest value.
    */
   protected static int _nextToAssign = _lowestValue;

   /**
    * This is the only public constructor.
    * Each user-defined instance of a <code>TransportationType</code>
must be initialized with one of the defined static values.
    * @param otherTransportationTypeValue must be a defined static
value or another instance.
    */
   public TransportationType(TransportationType
otherTransportationTypeValue)
   {
      _value = otherTransportationTypeValue._value;
   }
   /**
    * Class and subclass constructor; it is used to generate the
static values.
    * Because this class is RTI-extendable, the constructor is
protected instead of private.
    */
   protected TransportationType()
   {
      _value = _nextToAssign++;
   }

   /**
    * Package-only (default access) constructor. Used by the {@link
TransportationType#decode decode} method.
    * @param value an <code>int</code> to assign to the instance; must
be one of the static values
    */
   TransportationType(int value)
      throws RTIinternalError
   {
      _value = value;
      if ((value < _lowestValue) || (value >= _nextToAssign))
         throw new RTIinternalError("TransportationType: illegal value
" + value);
   }

   /**
    * Returns a <code>String</code> representation of the
<code>TransportationType</code>.
    * @return A {@link java.lang.String} with value
"TransportationType(n)" where n is <code>this</code> value
    */
   public String
   toString()
   {
      return "TransportationType(" + _value + ")";
   }

   /**
    * Returns true iff <code>this</code> and
<code>otherTransportationTypeValue</code> represent the same
transportation type.
    * @param otherTransportationTypeValue The <code>Object</code> to
compare with
    * @return <code>true</code> iff supplied
<code>otherTransportationTypeValue</code> is of type
<code>TransportationType</code> and has same value
    */
   public boolean
   equals(Object otherTransportationTypeValue)
   {
      if (otherTransportationTypeValue instanceof TransportationType)
         return _value ==
((TransportationType)otherTransportationTypeValue)._value;
      else
         return false;
   }
   /**
    * Returns a hash code for <code>this</code>; two
<code>TransportationType</code>s for which <code>equals()</code> is
<code>true</code> should yield the same hash code.
    * @return An <code>int</code> hash code
    */
   public int
   hashCode()
   {
      return _value;
   }

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of the <code>TransportationType</code>.
    * @return The length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength()
   {
      return 1;
   }

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    */
   public void
   encode(byte[] buffer,
          int    offset)
   {
      buffer[offset] = (byte)_value;
   }
   /**
    * Creates a <code>TransportationType</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>TransportationType</code>
    * @param offset where in the <code>buffer</code> the
<code>TransportationType</code> representation begins
    * @return The <code>TransportationType</code> that was encoded in
the provided <code>buffer</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded into an instance of the factory's target class
    */
   public static TransportationType
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode
   {
      int val = buffer[offset];
      TransportationType neo;
      try
      {
         neo = new TransportationType(val);
      }
      catch (RTIinternalError e)
      {
         throw new CouldNotDecode(e.getMessage());
      }
      return neo;
   }

   //The two core static instances
   /**
    * Provides reliable delivery of data in the sense that TCP/IP
delivers its data reliably.
    * Speed is sacrificed for reliability.
    */
   static public final TransportationType
   HLA_RELIABLE = new TransportationType();

   /**
    * Makes an effort to deliver data in the sense that UDP provides
best-effort delivery.
    * Reliability is sacrificed for speed.
    */
   static public final TransportationType
   HLA_BEST_EFFORT = new TransportationType();
}
//end TransportationType
```

```
// File: RTIexception.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * Superclass of all exceptions thrown by the RTI.
 * All RTI exceptions must be caught or specified.
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public class
RTIexception
   extends Exception
{
   /**
    * Constructs a new exception with the specified detail message.
    * The cause is not initialized, and may subsequently be
initialized by a call to {@link
java.lang.Throwable#initCause(java.lang.Throwable)}.
    * @param msg a {@link java.lang.String} holding the detail
message, which can be later retrieved by the {@link
java.lang.Throwable#getMessage getMessage} method
    */
   public RTIexception(String msg)
   {
      super(msg);
   }
}
//end RTIexception
```

The various RTIexception descendents follow a single format. Using the template listed below, the expressions <exception_name> and <exception_description> are to be replaced successively with the values given by the table that follows the template. The proposed exception InvalidLogicalTimeInterval is listed separately.

```
// File: <exception_name>.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * <exception_description>
 * @author  IEEE
 * @version 1516.1.5 (DoD v2)
 */
public final class
<exception_name>
   extends RTIexception
{
   /**
    * Constructs a new exception with the specified detail message.
    * The cause is not initialized, and may subsequently be
initialized by a call to {@link
java.lang.Throwable#initCause(java.lang.Throwable)}.
    * @param msg a {@link java.lang.String} holding the detail
message, which can be later retrieved by the {@link
java.lang.Throwable#getMessage} method
    */
   public
   <exception_name> (String msg)
   {
      super(msg);
   }
}
//end <exception_name>
```

<exception_name>	<exception_description>
AsynchronousDeliveryAlreadyDisabled	Exception thrown by the (8.15) {@link RTIambassador#disableAsynchronousDelivery disableAsynchronousDelivery} method when asynchronous delivery is already disabled for the federate.
AsynchronousDeliveryAlreadyEnabled	Exception thrown by the (8.14) {@link RTIambassador#enableAsynchronousDelivery enableAsynchronousDelivery} method when asynchronous delivery is already enabled for the federate.
AttributeAcquisitionWasNotCanceled	Exception that should be thrown by the (7.15) {@link FederateAmbassador#confirmAttributeOwnershipAcquisitionCancellation confirmAttributeOwnershipAcquisitionCancellation} callback if the federate wishes to repudiate the attribute ownership acquisition cancellation.
AttributeAcquisitionWasNotRequested	Exception thrown by the (7.14) {@link RTIambassador#cancelAttributeOwnershipAcquisition cancelAttributeOwnershipAcquisition} method when the attribute ownership acquisition request to cancel was not previously made. <p> It should also be thrown by the (7.7) {@link FederateAmbassador#attributeOwnershipAcquisitionNotification attributeOwnershipAcquisitionNotification} and (7.10) {@link FederateAmbassador#attributeOwnershipUnavailable attributeOwnershipUnavailable} callbacks when the attribute ownership acquisition being granted or denied (respectively) is not recognised as having been previously requested.
AttributeAlreadyBeingAcquired	Exception thrown by the (7.9) {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable attributeOwnershipAcquisitionIfAvailable} method when an unconditional attribute ownership acquisition request is pending for the specified attribute instances.

<exception_name>	<exception_description>
AttributeAlreadyBeingDivested	Exception thrown by the (7.3) {@link RTIambassador#negotiatedAttributeOwnershipDivestiture negotiatedAttributeOwnershipDivestiture} method when an attribute ownership divestiture request is already pending for the specified attribute instances.
AttributeAlreadyOwned	Exception thrown by the (7.14) {@link RTIambassador#cancelAttributeOwnershipAcquisition cancelAttributeOwnershipAcquisition} method when the federate's attribute ownership acquisition cancellation occurs too late (i.e. it has already been granted ownership). <p> It should also be thrown by the (7.4) {@link FederateAmbassador#requestAttributeOwnershipAssumption requestAttributeOwnershipAssumption}, (7.7) {@link FederateAmbassador#attributeOwnershipAcquisitionNotification attributeOwnershipAcquisitionNotification}, (7.10) {@link FederateAmbassador#attributeOwnershipUnavailable attributeOwnershipUnavailable} and (7.15) {@link FederateAmbassador#confirmAttributeOwnershipAcquisitionCancellation confirmAttributeOwnershipAcquisitionCancellation} callbacks when the attribute ownership acquisition being offered, granted, denied or cancelled (respectively) conflicts with the federate's perceived ownership.
AttributeDivestitureWasNotRequested	Exception thrown by the (7.14) {@link RTIambassador#cancelAttributeOwnershipAcquisition cancelAttributeOwnershipAcquisition} method when the federate's attribute ownership acquisition cancellation occurs too late (i.e. it has already been granted ownership). <p> It should also be thrown by the (7.4) {@link FederateAmbassador#requestAttributeOwnershipAssumption requestAttributeOwnershipAssumption}, (7.7) {@link FederateAmbassador#attributeOwnershipAcquisitionNotification attributeOwnershipAcquisitionNotification}, (7.10) {@link FederateAmbassador#attributeOwnershipUnavailable attributeOwnershipUnavailable} and (7.15) {@link FederateAmbassador#confirmAttributeOwnershipAcquisitionCancellation confirmAttributeOwnershipAcquisitionCancellation} callbacks when the attribute ownership acquisition being offered, granted, denied or cancelled (respectively) conflicts with the federate's perceived ownership.

<exception_name>
<exception_description>
AttributeNotDefined
Exception thrown when the specified attribute could not be recognised within the supplied context. The following RTIambassador methods throw it: <ul> <li>{@link RTIambassador#publishObjectClassAttributes publish} / {@link RTIambassador#unpublishObjectClassAttributes unpublish} ObjectClassAttributes <li>{@link RTIambassador#subscribeObjectClassAttributes subscribe} (including {@link RTIambassador#subscribeObjectClassAttributesPassively Passively} / {@link RTIambassador#unsubscribeObjectClassAttributes unsubscribe} ObjectClassAttributes <li>{@link RTIambassador#updateAttributeValues updateAttributeValues} (both forms) <li>changeAttribute {@link RTIambassador#changeAttributeTransportationType Transportation} / {@link RTIambassador#changeAttributeOrderType Order} Type <li>{@link RTIambassador#requestAttributeValueUpdate requestAttributeValueUpdate} (both forms) {@link RTIambassador#requestAttributeValueUpdateWithRegions [WithRegions]} <li>{@link RTIambassador#unconditionalAttributeOwnershipDivestiture unconditional} / {@link RTIambassador#negotiatedAttributeOwnershipDivestiture negotiated} AttributeOwnershipDivestiture {@link RTIambassador#attributeOwnershipDivestitureIfWanted [IfWanted]} <li>{@link RTIambassador#cancelNegotiatedAttributeOwnershipDivestiture cancelNegotiatedAttributeOwnershipDivestiture} <li>{@link RTIambassador#confirmDivestiture confirmDivestiture} <li>{@link RTIambassador#cancelAttributeOwnershipAcquisition [cancel]} {@link RTIambassador#attributeOwnershipAcquisition attributeOwnershipAcquisition} {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable [IfAvailable]} <li>{@link RTIambassador#queryAttributeOwnership queryAttributeOwnership} <li>{@link RTIambassador#isAttributeOwnedByFederate isAttributeOwnedByFederate} <li>{@link RTIambassador#registerObjectInstanceWithRegions registerObjectInstanceWithRegions} (both forms) <li>{@link RTIambassador#associateRegionsForUpdates associate} / {@link RTIambassador#unassociateRegionsForUpdates unassociate} RegionsForUpdates <li>{@link RTIambassador#subscribeObjectClassAttributesWithRegions subscribe} (including {@link RTIambassador#subscribeObjectClassAttributesPassivelyWithRegions Passively}) / {@link RTIambassador#unsubscribeObjectClassAttributesWithRegions unsubscribe} ObjectClassAttributesWithRegions <li>{@link RTIambassador#getAttributeName getAttributeName} <li>{@link RTIambassador#getAvailableDimensionsForClassAttribute getAvailableDimensionsForClassAttribute} </ul>

<exception_name>	<exception_description>
AttributeNotOwned	Exception thrown when the specified attribute instance(s) was(were) not owned by the federate. The following RTIambassador methods throw it: <ul> <li>{@link RTIambassador#updateAttributeValues updateAttributeValues} (both forms) <li>changeAttribute {@link RTIambassador#changeAttributeTransportationType Transportation} / {@link RTIambassador#changeAttributeOrderType Order} Type <li>{@link RTIambassador#unconditionalAttributeOwnershipDivestiture unconditional} / {@link RTIambassador#negotiatedAttributeOwnershipDivestiture negotiated} AttributeOwnershipDivestiture {@link RTIambassador#attributeOwnershipDivestitureIfWanted [IfWanted]} <li>{@link RTIambassador#cancelNegotiatedAttributeOwnershipDivestiture cancelNegotiatedAttributeOwnershipDivestiture} <li>{@link RTIambassador#confirmDivestiture confirmDivestiture} </ul> <p> It should also be thrown by the following FederateAmbassador callbacks when the federate repudiates ownership of the specified attribute instances: <ul> <li>{@link FederateAmbassador#provideAttributeValueUpdate provideAttributeValueUpdate} <li>turnUpdates {@link FederateAmbassador#turnUpdatesOnForObjectInstance On} / {@link FederateAmbassador#turnUpdatesOffForObjectInstance Off} ForObjectInstance <li>{@link FederateAmbassador#requestDivestitureConfirmation requestDivestitureConfirmation} <li>{@link FederateAmbassador#requestAttributeOwnershipRelease requestAttributeOwnershipRelease} </ul>
AttributeNotPublished	Exception thrown by the (7.8/7.9) {@link RTIambassador#attributeOwnershipAcquisition attributeOwnershipAcquisition} {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable [IfAvailable]} and (9.5) {@link RTIambassador#registerObjectInstanceWithRegions registerObjectInstanceWithRegions} (both forms) methods when some of the attributes to acquire or register aren't published. <p> It should also be thrown by the (7.4) {@link FederateAmbassador#requestAttributeOwnershipAssumption requestAttributeOwnershipAssumption} and (7.7) {@link FederateAmbassador#attributeOwnershipAcquisitionNotification attributeOwnershipAcquisitionNotification} callbacks when some of the offered or granted attributes aren't published in the federate's opinion.

<exception_name>	<exception_description>
AttributeNotRecognized	Exception that should be thrown when the specified attributes aren't recognized by the federate in the supplied object class context. The following FederateAmbassador callbacks should throw it:<ul> <li>{@link FederateAmbassador#reflectAttributeValues reflectAttributeValues} (all six forms) <li>attributes {@link FederateAmbassador#attributesInScope In} / {@link FederateAmbassador#attributesOutOfScope OutOf} Scope <li>{@link FederateAmbassador#provideAttributeValueUpdate provideAttributeValueUpdate} <li>turnUpdates {@link FederateAmbassador#turnUpdatesOnForObjectInstance On} / {@link FederateAmbassador#turnUpdatesOffForObjectInstance Off} ForObjectInstance <li>{@link FederateAmbassador#requestAttributeOwnershipAssumption requestAttributeOwnershipAssumption} <li>{@link FederateAmbassador#requestDivestitureConfirmation requestDivestitureConfirmation} <li>{@link FederateAmbassador#attributeOwnershipAcquisitionNotification attributeOwnershipAcquisitionNotification} <li>{@link FederateAmbassador#attributeOwnershipUnavailable attributeOwnershipUnavailable} <li>{@link FederateAmbassador#requestAttributeOwnershipRelease requestAttributeOwnershipRelease} <li>{@link FederateAmbassador#confirmAttributeOwnershipAcquisitionCancellation confirmAttributeOwnershipAcquisitionCancellation} <li>{@link FederateAmbassador#informAttributeOwnership informAttributeOwnership} <li>{@link FederateAmbassador#attributeIsNotOwned attributeIsNotOwned} <li>{@link FederateAmbassador#attributeIsOwnedByRTI attributeIsOwnedByRTI} </ul>
AttributeNotSubscribed	Exception that should be thrown by the (6.7) {@link FederateAmbassador#reflectAttributeValues reflectAttributeValues} (all six forms) and (6.15/6.16) attributes {@link FederateAmbassador#attributesInScope In} / {@link FederateAmbassador#attributesOutOfScope OutOf} Scope callbacks when the specified attributes aren't published by the federate in its opinion.
AttributeRelevanceAdvisorySwitchIsOff	Exception thrown by the (10.25) {@link RTIambassador#disableAttributeRelevanceAdvisorySwitch disableAttributeRelevanceAdvisorySwitch} method when the attribute relevance advisory switch is already off.

<exception_name>	<exception_description>
AttributeRelevanceAdvisorySwitchIsOn	Exception thrown by the (10.24) {@link RTIambassador#enableAttributeRelevanceAdvisorySwitch enableAttributeRelevanceAdvisorySwitch} method when the attribute relevance advisory switch is already on.
AttributeScopeAdvisorySwitchIsOff	Exception thrown by the (10.27) {@link RTIambassador#disableAttributeScopeAdvisorySwitch disableAttributeScopeAdvisorySwitch} method when the attribute scope advisory switch is already off.
AttributeScopeAdvisorySwitchIsOn	Exception thrown by the (10.26) {@link RTIambassador#enableAttributeScopeAdvisorySwitch enableAttributeScopeAdvisorySwitch} method when the attribute scope advisory switch is already on.
CouldNotDecode	Exception thrown by the <code>decode</code> method of a factory class when it fails to decode the specified byte buffer into an instance of the factory's target class. The following factory classes throw it:<ul> <li>{@link AttributeHandleFactory} <li>{@link DimensionHandleFactory} <li>{@link FederateHandleFactory} <li>{@link InteractionClassHandleFactory} <li>{@link LogicalTimeFactory} <li>{@link LogicalTimeIntervalFactory} <li>{@link ObjectClassHandleFactory} <li>{@link ObjectInstanceHandleFactory} <li>{@link ParameterHandleFactory} <li>{@link OrderType} <li>{@link TransportationType} </ul>
CouldNotDiscover	Exception that should be thrown by the (6.5) {@link FederateAmbassador#discoverObjectInstance discoverObjectInstance} callback when it fails for some reason other than an unrecognized object class.
CouldNotInitiateRestore	Exception that should be thrown by the (4.21) {@link FederateAmbassador#initiateFederateRestore initiateFederateRestore} callback when it fails for some reason other than an unrecognized save label.

<exception_name>	<exception_description>
CouldNotOpenFDD	Exception thrown by the (4.2) {@link RTIambassador#createFederationExecution createFederationExecution} method when it fails to reach or open the specified FOM Document Data (FDD) file.
DeletePrivilegeNotHeld	Exception thrown by the (4.2) {@link RTIambassador#createFederationExecution createFederationExecution} method when it fails to reach or open the specified FOM Document Data (FDD) file.
ErrorReadingFDD	Exception thrown by the (4.2) {@link RTIambassador#createFederationExecution createFederationExecution} method when the contents of the FOM Document Data (FDD) file prove unsuitable.
FederateAlreadyExecutionMember	Exception thrown by the (4.4) {@link RTIambassador#joinFederationExecution joinFederationExecution} method when the federate (as represented by the {@link RTIambassador} instance) is already joined to any federation execution (not just the specified one).
FederateHasNotBegunSave	Exception thrown by the (4.14) RTIambassador.federateSave {@link RTIambassador#federateSaveNotComplete [Not]} {@link RTIambassador#federateSaveComplete Complete} methods if the federate is not in the Saving state.
FederateInternalError	Exception that should be thrown by all of the {@link FederateAmbassador}'s callbacks when something goes wrong unless a more specific exception is appropriate.
FederateNotExecutionMember	Exception thrown by nearly all of the {@link RTIambassador}'s methods if the federate isn't joined.

<exception_name>	<exception_description>
FederateOwnsAttributes	Exception thrown by the (4.5) {@link RTIambassador#resignFederationExecution resignFederationExecution}, (6.12) {@link RTIambassador#localDeleteObjectInstance localDeleteObjectInstance} and (7.8/7.9) {@link RTIambassador#attributeOwnershipAcquisition attributeOwnershipAcquisition} {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable [IfAvailable]} methods if the federate, in the first case, owns some instance attributes and hasn't specified a disposal policy; or, in the latter cases, owns some of the attributes it is trying to locally delete or acquire.
FederatesCurrentlyJoined	Exception thrown by the (4.3) {@link RTIambassador#destroyFederationExecution destroyFederationExecution} method if the federation execution isn't empty.
FederateServiceInvocationsAreBeingReportedViaMOM	Exception thrown by the (5.8/9.10) {@link RTIambassador#subscribeInteractionClass subscribeInteractionClass} {@link RTIambassador#subscribeInteractionClassPassively [Passively]} {@link RTIambassador#subscribeInteractionClassWithRegions [WithRegions]} methods if service invocations are currently being reported via MOM interactions and the specified interaction class is <code>HLAmanager.HLAfederate.HLAreport.HLAreportServiceInvocation</code>. Such a subscription would cause an infinite loop (the first invocation would trigger a report of itself and so on).
FederateUnableToUseTime	Exception thrown by the (4.11) {@link RTIambassador#requestFederationSave(String,LogicalTime)} (time-stamped form) method if the specified time-stamp, although not in the federate's past, is nevertheless too soon to be achievable.
FederationExecutionAlreadyExists	Exception thrown by the (4.2) {@link RTIambassador#createFederationExecution createFederationExecution} method if the specified federation execution already exists.

<exception_name>	<exception_description>
FederationExecutionDoesNotExist	Exception thrown by the (4.3) {@link RTIambassador#destroyFederationExecution destroyFederationExecution} and (4.4) {@link RTIambassador#joinFederationExecution joinFederationExecution} methods if the specified federation execution does not exist.
IllegalName	Exception thrown by the (6.2) {@link RTIambassador#reserveObjectInstanceName reserveObjectInstanceName} method if the specified object instance name is ill-formed. <p> Object instance names may not be the empty String (""), nor begin with "HLA" (including all case variations such as "hla" or "Hla"), nor equal "na"; there are no other restrictions. <p> Names are constructed from a combination of letters (a..z and A..Z), digits (0..9), hyphens and underscores. The period is used to qualify a class; it is the "path" character linking a super-class with its sub-class. These rules apply to object and interaction classes, attributes and parameters, datatypes (including enumerators and values), record fields, dimensions, transportation types, synchronization point labels and OMT note labels. It is not made clear anywhere whether these rules apply to object instance names, although this is probably a safe assumption.
IllegalTimeArithmetic	Exception thrown by the LogicalTime {@link LogicalTime#add add} and {@link LogicalTime#subtract subtract} methods if adding (subtracting) the specified {@link LogicalTimeInterval} would result in a <code>LogicalTime</code> lying after (before) the final (initial) <code>LogicalTime</code>.

<exception_name>	<exception_description>
InteractionClassNotDefined	Exception thrown by the (5.4/5.5) {@link RTIambassador#publishInteractionClass publish} / {@link RTIambassador#unpublishInteractionClass unpublish} InteractionClass, (5.8/9.10) {@link RTIambassador#subscribeInteractionClass subscribeInteractionClass} {@link RTIambassador#subscribeInteractionClassPassively [Passively]} {@link RTIambassador#subscribeInteractionClassWithRegions [WithRegions]}, (5.9/9.11) {@link RTIambassador#unsubscribeInteractionClass unsubscribeInteractionClass} {@link RTIambassador#unsubscribeInteractionClassWithRegions [WithRegions]}, (6.8/9.12) {@link RTIambassador#sendInteraction sendInteraction} {@link RTIambassador#sendInteractionWithRegions [WithRegions]} (all forms) and (6.14/8.24) changeInteraction {@link RTIambassador#changeInteractionTransportationType Transportation} / {@link RTIambassador#changeInteractionOrderType Order} Type methods when the specified interaction class isn't recognized.
InteractionClassNotPublished	Exception thrown by the (6.8/9.12) {@link RTIambassador#sendInteraction sendInteraction} {@link RTIambassador#sendInteractionWithRegions [WithRegions]} (all forms) and (6.14/8.24) changeInteraction {@link RTIambassador#changeInteractionTransportationType Transportation} / {@link RTIambassador#changeInteractionOrderType Order} Type methods when the specified interaction class isn't currently published by the federate. <p> It should also be thrown by the (5.12/5.13) FederateAmbassador.turnInteractions {@link FederateAmbassador#turnInteractionsOn On} / {@link FederateAmbassador#turnInteractionsOff Off} callbacks if the federate denies publishing the specified interaction class.
InteractionClassNotRecognized	Exception that should be thrown by the (6.9) {@link FederateAmbassador#receiveInteraction receiveInteraction} (all forms) callback if the federate does not recognize the supplied interaction class.
InteractionClassNotSubscribed	Exception that should be thrown by the (6.9) {@link FederateAmbassador#receiveInteraction receiveInteraction} (all forms) callback if the federate denies subscribing to the supplied interaction class.

<exception_name>	<exception_description>
InteractionParameterNotDefined	Exception thrown by the (6.8/9.12) {@link RTIambassador#sendInteraction sendInteraction} {@link RTIambassador#sendInteractionWithRegions [WithRegions]} (both forms) and (10.9) {@link RTIambassador#getParameterName getParameterName} methods when (at least one of) the specified parameter(s) isn't defined in the context of the specified interaction class.
InteractionParameterNotRecognized	Exception that should be thrown by the (6.9) {@link FederateAmbassador#receiveInteraction receiveInteraction} (all forms) callback if at least one of the supplied parameters isn't recognized in the context of the specified interaction class.
InteractionRelevanceAdvisorySwitchIsOff	Exception thrown by the (10.29) {@link RTIambassador#disableInteractionRelevanceAdvisorySwitch disableInteractionRelevanceAdvisorySwitch} method when the interaction relevance advisory switch is already off.
InteractionRelevanceAdvisorySwitchIsOn	Exception thrown by the (10.28) {@link RTIambassador#enableInteractionRelevanceAdvisorySwitch enableInteractionRelevanceAdvisorySwitch} method when the interaction relevance advisory switch is already on.
InTimeAdvancingState	Exception thrown by the (8.2) {@link RTIambassador#enableTimeRegulation enableTimeRegulation}, (8.5) {@link RTIambassador#enableTimeConstrained enableTimeConstrained}, (8.8/8.9){@link RTIambassador#timeAdvanceRequest timeAdvanceRequest} {@link RTIambassador#timeAdvanceRequestAvailable [Available]}, (8.10/8.11) {@link RTIambassador#nextMessageRequest nextMessageRequest} {@link RTIambassador#nextMessageRequestAvailable [Available]}, (8.12) {@link RTIambassador#flushQueueRequest flushQueueRequest} and (8.19) {@link RTIambassador#modifyLookahead modifyLookahead} methods when the federate is in the Time Advancing state.
InvalidAttributeHandle	Exception thrown by the (10.5) {@link RTIambassador#getAttributeName getAttributeName} and (10.15) {@link RTIambassador#getAvailableDimensionsForClassAttribute getAvailableDimensionsForClassAttribute} methods when the specified attribute handle doesn't exist (in any object class context).

<exception_name>	<exception_description>
InvalidDimensionHandle	Exception thrown by the (9.2) {@link RTIambassador#createRegion createRegion}, (10.13) {@link RTIambassador#getDimensionName getDimensionName} and (10.14) {@link RTIambassador#getDimensionUpperBound getDimensionUpperBound} methods when (one of) the specified dimension handle(s) doesn't exist.
InvalidFederateHandle	Exception thrown by the (10.33) {@link RTIambassador#normalizeFederateHandle normalizeFederateHandle} method when the specified federate handle is invalid. <p> Note that when the (4.6) {@link RTIambassador#registerFederationSynchronizationPoint(String,byte[],FederateHandleSet)} method is supplied a {@link FederateHandleSet} that includes one or more invalid federate handles, it does not throw this exception. Instead the RTI invokes the {@link FederateAmbassador#synchronizationPointRegistrationFailed synchronizationPointRegistrationFailed} callback with the reason <code>SYNCHRONIZATION_SET_MEMBER_NOT_JOINED</code>.
InvalidInteractionClassHandle	Exception thrown by the (10.7) {@link RTIambassador#getInteractionClassName getInteractionClassName}, (10.8) {@link RTIambassador#getParameterHandle getParameterHandle}, (10.9) {@link RTIambassador#getParameterName getParameterName} and (10.17) {@link RTIambassador#getAvailableDimensionsForInteractionClass getAvailableDimensionsForInteractionClass} methods when the specified interaction class handle is invalid.

<exception_name>	<exception_description>
InvalidLogicalTime	Exception thrown by the (4.11) {@link RTIambassador#requestFederationSave(String,LogicalTime)}, (6.6) {@link RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHandleValueMap,byte[],LogicalTime)}, (6.8) {@link RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleValueMap,byte[],LogicalTime)}, (9.12) {@link RTIambassador#sendInteractionWithRegions(InteractionClassHandle,ParameterHandleValueMap,RegionHandleSet,byte[],LogicalTime)}, (6.10) {@link RTIambassador#deleteObjectInstance(ObjectInstanceHandle,byte[],LogicalTime)}, (8.8/8.9) {@link RTIambassador#timeAdvanceRequest timeAdvanceRequest} {@link RTIambassador#timeAdvanceRequestAvailable [Available]}, (8.10/8.11) {@link RTIambassador#nextMessageRequest nextMessageRequest} {@link RTIambassador#nextMessageRequestAvailable [Available]} and (8.12) {@link RTIambassador#flushQueueRequest flushQueueRequest} methods when the specified time-stamp is invalid. <p> It should also be thrown by the (4.12) {@link FederateAmbassador#initiateFederateSave(String,LogicalTime)}, (6.7) {@link FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,AttributeHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderType,MessageRetractionHandle)}, {@link FederateAmbassador#reflectAttributeValues(ObjectInstanceHandle,AttributeHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderType,MessageRetractionHandle,RegionHandleSet)}, (6.9) {@link FederateAmbassador#receiveInteraction(InteractionClassHandle,ParameterHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderType,MessageRetractionHandle)}, {@link FederateAmbassador#receiveInteraction(InteractionClassHandle,ParameterHandleValueMap,byte[],OrderType,TransportationType,LogicalTime,OrderType,MessageRetractionHandle,RegionHandleSet)}, (6.11) {@link FederateAmbassador#removeObjectInstance(ObjectInstanceHandle,byte[],OrderType,LogicalTime,OrderType,MessageRetractionHandle)}, (8.3) {@link FederateAmbassador#timeRegulationEnabled timeRegulationEnabled}, (8.6) {@link FederateAmbassador#timeConstrainedEnabled timeConstrainedEnabled} and (8.13) {@link FederateAmbassador#timeAdvanceGrant timeAdvanceGrant} callbacks if the federate considers the time-stamp invalid.
InvalidLookahead	Exception thrown by the (8.2) {@link RTIambassador#enableTimeRegulation enableTimeRegulation} and (8.19) {@link RTIambassador#modifyLookahead modifyLookahead} methods when the supplied lookahead {@link LogicalTimeInterval} is invalid.

<exception_name>
<exception_description>
InvalidMessageRetractionHandle
Exception thrown by the (8.21) {@link RTIambassador#retract retract} method when the supplied {@link MessageRetractionHandle} is invalid.
InvalidObjectClassHandle
Exception thrown by the (10.3) {@link RTIambassador#getObjectClassName getObjectClassName}, (10.4) {@link RTIambassador#getAttributeHandle getAttributeHandle}, (10.5) {@link RTIambassador#getAttributeName getAttributeName} and (10.15) {@link RTIambassador#getAvailableDimensionsForClassAttribute getAvailableDimensionsForClassAttribute} methods when the supplied {@link ObjectClassHandle} is invalid.
InvalidOrderName
Exception thrown by the (10.20) {@link RTIambassador#getOrderType getOrderType} method when the supplied order type name is invalid. <p> As specified in {@link OrderType}, the two possible order type names are <code>RECEIVE</code> and <code>TIMESTAMP</code>.
InvalidOrderType
Exception thrown by the (10.21) {@link RTIambassador#getOrderName getOrderName} method when the supplied {@link OrderType} is invalid.
InvalidParameterHandle
Exception thrown by the (10.9) {@link RTIambassador#getParameterName getParameterName} method when the supplied {@link ParameterHandle} is invalid.
InvalidRangeBound
Exception thrown by the (10.32) {@link RTIambassador#setRangeBounds setRangeBounds} method when the supplied {@link RangeBounds} is invalid.

<exception_name>
<exception_description>
InvalidRegion
Exception thrown by the (9.3) {@link RTIambassador#commitRegionModifications commitRegionModifications}, (9.4) {@link RTIambassador#deleteRegion deleteRegion}, (9.5) {@link RTIambassador#registerObjectInstanceWithRegions registerObjectInstanceWithRegions} (both forms), (9.6) {@link RTIambassador#associateRegionsForUpdates associateRegionsForUpdates}, (9.7) {@link RTIambassador#unassociateRegionsForUpdates unassociateRegionsForUpdates}, (9.8) {@link RTIambassador#subscribeObjectClassAttributesWithRegions subscribeObjectClassAttributesWithRegions} {@link RTIambassador#subscribeObjectClassAttributesPassivelyWithRegions [Passively]}, (9.9) {@link RTIambassador#unsubscribeObjectClassAttributesWithRegions unsubscribeObjectClassAttributesWithRegions}, (9.10) {@link RTIambassador#subscribeInteractionClassWithRegions subscribeInteractionClassWithRegions} {@link RTIambassador#subscribeInteractionClassPassivelyWithRegions [Passively]}, (9.11) {@link RTIambassador#unsubscribeInteractionClassWithRegions unsubscribeInteractionClassWithRegions}, (9.12) {@link RTIambassador#sendInteractionWithRegions sendInteractionWithRegions} (both forms), (9.13) {@link RTIambassador#requestAttributeValueUpdateWithRegions requestAttributeValueUpdateWithRegions}, (10.30) {@link RTIambassador#getDimensionHandleSet getDimensionHandleSet}, (10.31) {@link RTIambassador#getRangeBounds getRangeBounds} and (10.32) {@link RTIambassador#setRangeBounds setRangeBounds} methods when the supplied {@link RegionHandle} (which for most methods is included in a {@link RegionHandleSet} or {@link AttributeSetRegionSetPairList}) is invalid. <p> In particular, {@link RTIambassador#commitRegionModifications commitRegionModifications} throws this exception if any of a region template's specified dimensions have not had their RangeBounds set beforehand.

<exception_name>	<exception_description>
InvalidRegionContext	Exception thrown by the (9.5) {@link RTIambassador#registerObjectInstanceWithRegions registerObjectInstanceWithRegions} (both forms), (9.6) {@link RTIambassador#associateRegionsForUpdates associateRegionsForUpdates}, (9.8) {@link RTIambassador#subscribeObjectClassAttributesWithRegions subscribeObjectClassAttributesWithRegions} {@link RTIambassador#subscribeObjectClassAttributesPassivelyWithRegions [Passively]}, (9.10) {@link RTIambassador#subscribeInteractionClassWithRegions subscribeInteractionClassWithRegions} {@link RTIambassador#subscribeInteractionClassPassivelyWithRegions [Passively]}, (9.12) {@link RTIambassador#sendInteractionWithRegions sendInteractionWithRegions} (both forms) and (9.13) {@link RTIambassador#requestAttributeValueUpdateWithRegions requestAttributeValueUpdateWithRegions} methods when the specified dimensions of one of the <code>Region</code>s (supplied by a {@link RegionHandleSet} or {@link AttributeSetRegionSetPairList} argument) are not a subset of the available dimensions of the specified class attributes (as described by the FOM Document Data).
InvalidServiceGroup	Exception thrown by the (10.34) {@link RTIambassador#normalizeServiceGroup normalizeServiceGroup} method when the specified {@link ServiceGroup} is invalid.
InvalidTransportationName	Exception thrown by the (10.18) {@link RTIambassador#getTransportationType getTransportationType} method when the specified transportation type name is invalid. <p> As specified in {@link TransportationType}, the two core transportation type names are <code>HLAreliable</code> and <code>HLAbestEffort</code>; additional <code>TransportationType</code>s may be provided by specific RTIs.
InvalidTransportationType	Exception thrown by the (10.19) {@link RTIambassador#getTransportationName getTransportationName} method when the specified {@link TransportationType} is invalid.
JoinedFederateIsNotInTimeAdvancingState	Exception that should be thrown by the (8.13) {@link FederateAmbassador#timeAdvanceGrant timeAdvanceGrant} callback if the federate does not consider itself in the Time Advancing state.

<exception_name>	<exception_description>
LogicalTimeAlreadyPassed	Exception thrown by the (4.11) {@link RTIambassador#requestFederationSave requestFederationSave}, (8.8/8.9) {@link RTIambassador#timeAdvanceRequest timeAdvanceRequest} {@link RTIambassador#timeAdvanceRequestAvailable [Available]}, (8.10/8.11) {@link RTIambassador#nextMessageRequest nextMessageRequest} {@link RTIambassador#nextMessageRequestAvailable [Available]} and (8.12) {@link RTIambassador#flushQueueRequest flushQueueRequest} methods when the specified {@link LogicalTime} is in the federation's past.
MessageCanNoLongerBeRetracted	Exception thrown by the (8.21) {@link RTIambassador#retract retract} method when the message associated with the specified {@link MessageRetractionHandle} can no longer be retracted. A federate in the Time Granted state can only retract messages with time stamps larger than the federate's current logical time plus its actual lookahead. A federate in the Time Advancing state can only retract messages with time stamps larger than the logical time specified in the federate's most recent (8.8) {@link RTIambassador#timeAdvanceRequest timeAdvanceRequest} plus its actual lookahead.
NameNotFound	Exception thrown by the (10.2) {@link RTIambassador#getObjectClassHandle getObjectClassHandle}, (10.4) {@link RTIambassador#getAttributeHandle getAttributeHandle}, (10.6) {@link RTIambassador#getInteractionClassHandle getInteractionClassHandle}, (10.8) {@link RTIambassador#getParameterHandle getParameterHandle} and (10.12) {@link RTIambassador#getDimensionHandle getDimensionHandle} methods when the specified name isn't recognized.
NoAcquisitionPending	Exception thrown by the (7.6) {@link RTIambassador#confirmDivestiture confirmDivestiture} method when, although there is a negotiated divestiture request pending for the specified attributes, the (7.5) {@link FederateAmbassador#requestDivestitureConfirmation requestDivestitureConfirmation} callback has not yet occurred. The exception was missing from Annex B but not from the 7.6 clause. <p> Pitch pRTI 1516 version 2.3 states that "This is deliberately not a final class" without explaining why.

<exception_name>	**<exception_description>**
NoRequestToEnableTimeConstrainedWasPending	Exception that should be thrown by the (8.6) {@link FederateAmbassador#timeConstrainedEnabled timeConstrainedEnabled} callback if the federate wants to repudiate its request to become time-constrained.
NoRequestToEnableTimeRegulationWasPending	Exception that should be thrown by the (8.3) {@link FederateAmbassador#timeRegulationEnabled timeRegulationEnabled} callback if the federate wants to repudiate its request to become time-regulating.
ObjectClassNotDefined	Exception thrown by the {@link RTIambassador#publishObjectClassAttributes publishObjectClassAttributes}, {@link RTIambassador#unpublishObjectClass unpublishObjectClass}, {@link RTIambassador#unpublishObjectClassAttributes unpublishObjectClassAttributes}, {@link RTIambassador#subscribeObjectClassAttributes subscribeObjectClassAttributes} {@link RTIambassador#subscribeObjectClassAttributesPassively [Passively]} {@link RTIambassador#subscribeObjectClassAttributesWithRegions [WithRegions]}, {@link RTIambassador#unsubscribeObjectClass unsubscribeObjectClass}, {@link RTIambassador#unsubscribeObjectClassAttributes unsubscribeObjectClassAttributes} {@link RTIambassador#unsubscribeObjectClassAttributesWithRegions [WithRegions]}, {@link RTIambassador#registerObjectInstance registerObjectInstance} {@link RTIambassador#registerObjectInstanceWithRegions [WithRegions]} (all forms), {@link RTIambassador#requestAttributeValueUpdate(ObjectClassHandle,AttributeHandleSet,byte[])} and {@link RTIambassador#requestAttributeValueUpdateWithRegions requestAttributeValueUpdateWithRegions} methods when the supplied {@link ObjectClassHandle} isn't recognized.

<exception_name>	<exception_description>
ObjectClassNotPublished	Exception thrown by the (6.4/9.5) {@link RTIambassador#registerObjectInstance registerObjectInstance} {@link RTIambassador#registerObjectInstanceWithRegions [WithRegions]} (all forms) and (7.8/7.9) {@link RTIambassador#attributeOwnershipAcquisition attributeOwnershipAcquisition} {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable [IfAvailable]} methods when the supplied object class isn't currently published by the federate. <p> It should also be thrown by the (5.10) {@link FederateAmbassador#startRegistrationForObjectClass start} / (5.11) {@link FederateAmbassador#stopRegistrationForObjectClass stop} RegistrationForObjectClass callbacks if the federate does not publish the specified object class.
ObjectClassNotRecognized	Exception that should be thrown by the (6.5) {@link FederateAmbassador#discoverObjectInstance discoverObjectInstance} callback if the federate does not recognize the specified object class.
ObjectClassRelevanceAdvisorySwitchIsOff	Exception thrown by the (10.23) {@link RTIambassador#disableObjectClassRelevanceAdvisorySwitch disableObjectClassRelevanceAdvisorySwitch} method when the object class relevance advisory switch is already off.
ObjectClassRelevanceAdvisorySwitchIsOn	Exception thrown by the (10.22) {@link RTIambassador#enableObjectClassRelevanceAdvisorySwitch enableObjectClassRelevanceAdvisorySwitch} method when the object class relevance advisory switch is already on.
ObjectInstanceNameInUse	Exception thrown by the (6.4) {@link RTIambassador#registerObjectInstance(ObjectClassHandle,String)} and (9.5) {@link RTIambassador#registerObjectInstanceWithRegions(ObjectClassHandle,AttributeSetRegionSetPairList,String)} methods when the specified object instance name has already been used. An object instance name may not be re-used during the lifetime of the federation execution even if the object instance is deleted.

<exception_name>	<exception_description>
ObjectInstanceNameNotReserved	Exception thrown by the (6.4) {@link RTIambassador#registerObjectInstance(ObjectClassHandle,String)} and (9.5) {@link RTIambassador#registerObjectInstanceWithRegions(ObjectClassHandle,AttributeSetRegionSetPairList,String)} methods when the specified object instance name could not be reserved for some reason other than its having already been used. <p> Object instance names may not begin with "HLA" (including any case variations such as "Hla"). For details on name construction, see the {@link IllegalName} exception. <p> An object instance name may not be re-used during the lifetime of the federation execution even if the object instance is deleted.

<exception_name> **<exception_description>**
ObjectInstanceNotKnown
Exception thrown by the {@link RTIambassador#updateAttributeValues updateAttributeValues} (both forms), {@link RTIambassador#localDeleteObjectInstance [local]} {@link RTIambassador#deleteObjectInstance deleteObjectInstance} (all forms), changeAttribute {@link RTIambassador#changeAttributeTransportationType Transportation} / {@link RTIambassador#changeAttributeOrderType Order} Type, {@link RTIambassador#requestAttributeValueUpdate(ObjectInstanceHandle,AttributeHandleSet,byte[])}, {@link RTIambassador#unconditionalAttributeOwnershipDivestiture unconditional} / {@link RTIambassador#negotiatedAttributeOwnershipDivestiture negotiated} AttributeOwnershipDivestiture, {@link RTIambassador#confirmDivestiture confirmDivestiture}, {@link RTIambassador#attributeOwnershipAcquisition attributeOwnershipAcquisition} {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable [IfAvailable]}, {@link RTIambassador#attributeOwnershipDivestitureIfWanted attributeOwnershipDivestitureIfWanted}, {@link RTIambassador#cancelNegotiatedAttributeOwnershipDivestiture cancelNegotiatedAttributeOwnershipDivestiture}, {@link RTIambassador#cancelAttributeOwnershipAcquisition cancelAttributeOwnershipAcquisition}, {@link RTIambassador#queryAttributeOwnership queryAttributeOwnership}, {@link RTIambassador#isAttributeOwnedByFederate isAttributeOwnedByFederate}, {@link RTIambassador#associateRegionsForUpdates associateRegionsForUpdates}, {@link RTIambassador#unassociateRegionsForUpdates unassociateRegionsForUpdates}, getObjectInstance {@link RTIambassador#getObjectInstanceHandle Handle} / {@link RTIambassador#getObjectInstanceName Name} and {@link RTIambassador#getKnownObjectClassHandle getKnownObjectClassHandle} methods when the RTI considers that the specified {@link ObjectInstanceHandle} hasn't been discovered by the federate. <p>

(continued next page)

<exception_name>	**<exception_description>**
ObjectInstanceNotKnown **(continued from previous page)**	It should also be thrown by the {@link FederateAmbassador#reflectAttributeValues reflectAttributeValues} (all forms), {@link FederateAmbassador#removeObjectInstance removeObjectInstance} (both forms), attributes {@link FederateAmbassador#attributesInScope In} / {@link FederateAmbassador#attributesOutOfScope OutOf} Scope, {@link FederateAmbassador#provideAttributeValueUpdate provideAttributeValueUpdate}, turnUpdates {@link FederateAmbassador#turnUpdatesOnForObjectInstance On} / {@link FederateAmbassador#turnUpdatesOffForObjectInstance Off} ForObjectInstance, requestAttributeOwnership {@link FederateAmbassador#requestAttributeOwnershipAssumption Assumption} / {@link FederateAmbassador#requestAttributeOwnershipRelease Release}, {@link FederateAmbassador#requestDivestitureConfirmation requestDivestitureConfirmation}, {@link FederateAmbassador#attributeOwnershipAcquisitionNotification attributeOwnershipAcquisitionNotification}, {@link FederateAmbassador#attributeOwnershipUnavailable attributeOwnershipUnavailable}, {@link FederateAmbassador#confirmAttributeOwnershipAcquisitionCancellation confirmAttributeOwnershipAcquisitionCancellation}, {@link FederateAmbassador#informAttributeOwnership informAttributeOwnership}, {@link FederateAmbassador#attributeIsNotOwned attributeIsNotOwned} and {@link FederateAmbassador#attributeIsOwnedByRTI attributeIsOwnedByRTI} callbacks if the federate denies having previously discovered the object instance.
OwnershipAcquisitionPending	Exception thrown by the (4.5) {@link RTIambassador#resignFederationExecution resignFederationExecution}, (5.3) {@link RTIambassador#unpublishObjectClass unpublishObjectClass}, {@link RTIambassador#unpublishObjectClassAttributes unpublishObjectClassAttributes} and (6.12) {@link RTIambassador#localDeleteObjectInstance localDeleteObjectInstance} methods when there is at least one ownership acquisition pending for the specified object class (or any object class in the resignFederationExecution case).
RegionDoesNotContainSpecifiedDimension	Exception thrown by the (10.31) {@link RTIambassador#getRangeBounds getRangeBounds} and (10.32) {@link RTIambassador#setRangeBounds setRangeBounds} methods when the specified {@link DimensionHandle} is not bound to the specified {@link RegionHandle}.

<exception_name>	**<exception_description>**
RegionInUseForUpdateOrSubscription	Exception thrown by the (9.4) {@link RTIambassador#deleteRegion deleteRegion} method when the specified <code>Region</code> is still in use by the federation.
RegionNotCreatedByThisFederate	Exception thrown by the (9.3) {@link RTIambassador#commitRegionModifications commitRegionModifications}, (9.4) {@link RTIambassador#deleteRegion deleteRegion}, (9.5) {@link RTIambassador#registerObjectInstanceWithRegions registerObjectInstanceWithRegions} (both forms), (9.6) {@link RTIambassador#associateRegionsForUpdates associateRegionsForUpdates}, (9.7) {@link RTIambassador#unassociateRegionsForUpdates unassociateRegionsForUpdates}, (9.8) {@link RTIambassador#subscribeObjectClassAttributesWithRegions subscribeObjectClassAttributesWithRegions} (both forms), (9.9) {@link RTIambassador#unsubscribeObjectClassAttributesWithRegions unsubscribeObjectClassAttributesWithRegions}, (9.10) {@link RTIambassador#subscribeInteractionClassWithRegions subscribeInteractionClassWithRegions} {@link RTIambassador#subscribeInteractionClassPassivelyWithRegions [Passively]}, (9.11) {@link RTIambassador#unsubscribeInteractionClassWithRegions unsubscribeInteractionClassWithRegions}, (9.12) {@link RTIambassador#sendInteractionWithRegions sendInteractionWithRegions} (both forms), (9.13) {@link RTIambassador#requestAttributeValueUpdateWithRegions requestAttributeValueUpdateWithRegions} and (10.32) {@link RTIambassador#setRangeBounds setRangeBounds} methods when the federate attempts to modify or use a <code>Region</code> it did not create.
RequestForTimeConstrainedPending	Exception thrown by the (8.5) {@link RTIambassador#enableTimeConstrained enableTimeConstrained}, (8.8/8.9) {@link RTIambassador#timeAdvanceRequest timeAdvanceRequest} {@link RTIambassador#timeAdvanceRequestAvailable [Available]}, (8.10/8.11) {@link RTIambassador#nextMessageRequest nextMessageRequest} {@link RTIambassador#nextMessageRequestAvailable [Available]} and (8.12) {@link RTIambassador#flushQueueRequest flushQueueRequest} methods when an {@link RTIambassador#enableTimeConstrained enableTimeConstrained} request is pending.

<exception_name>	<exception_description>
RequestForTimeRegulationPending	Exception thrown by the (8.2) {@link RTIambassador#enableTimeRegulation enableTimeRegulation}, (8.8/8.9) {@link RTIambassador#timeAdvanceRequest timeAdvanceRequest} {@link RTIambassador#timeAdvanceRequestAvailable [Available]}, (8.10/8.11) {@link RTIambassador#nextMessageRequest nextMessageRequest} {@link RTIambassador#nextMessageRequestAvailable [Available]} and (8.12) {@link RTIambassador#flushQueueRequest flushQueueRequest} methods when an {@link RTIambassador#enableTimeRegulation enableTimeRegulation} request is pending.
RestoreInProgress	Exception thrown by nearly all of the {@link RTIambassador}'s methods when a federation restore is in progress. The methods that do not throw it are {@link RTIambassador#createFederationExecution create} / {@link RTIambassador#destroyFederationExecution destroy} / {@link RTIambassador#resignFederationExecution resign} FederationExecution, federateRestore {@link RTIambassador#federateRestoreNotComplete [Not]} {@link RTIambassador#federateRestoreComplete Complete}, {@link RTIambassador#queryFederationRestoreStatus queryFederationRestoreStatus}, all of the various <code>get</code> methods, normalize {@link RTIambassador#normalizeFederateHandle FederateHandle} / {@link RTIambassador#normalizeServiceGroup ServiceGroup}, {@link RTIambassador#evokeCallback evokeCallback} and {@link RTIambassador#evokeMultipleCallbacks evokeMultipleCallbacks}.
RestoreNotRequested	Exception thrown by the RTIambassador's (4.22) federateRestore {@link RTIambassador#federateRestoreNotComplete [Not]} {@link RTIambassador#federateRestoreComplete Complete} methods when a federation restore was not previously requested.
RTIinternalError	Exception thrown by all of the {@link RTIambassador}'s methods when something goes wrong and none of the more specific exceptions is appropriate.

<exception_name>	<exception_description>
SaveInProgress	Exception thrown by nearly all of the {@link RTIambassador}'s methods when a federation save is in progress. The methods that do not throw it are {@link RTIambassador#createFederationExecution create} / {@link RTIambassador#destroyFederationExecution destroy} / {@link RTIambassador#resignFederationExecution resign} FederationExecution, federateSave {@link RTIambassador#federateSaveBegun Begun} / {@link RTIambassador#federateSaveNotComplete [Not]} {@link RTIambassador#federateSaveComplete Complete} {@link RTIambassador#queryFederationSaveStatus queryFederationSaveStatus}, all of the various <code>get</code> methods, normalize {@link RTIambassador#normalizeFederateHandle FederateHandle} / {@link RTIambassador#normalizeServiceGroup ServiceGroup}, {@link RTIambassador#evokeCallback evokeCallback} and {@link RTIambassador#evokeMultipleCallbacks evokeMultipleCallbacks}.
SaveNotInitiated	Exception thrown by the (4.13) {@link RTIambassador#federateSaveBegun federateSaveBegun} method when a federation save was not previously requested.
SpecifiedSaveLabelDoesNotExist	Exception that should be thrown by the (4.21) {@link FederateAmbassador#initiateFederateRestore initiateFederateRestore} callback if the federate cannot find the specified save label.
SynchronizationPointLabelNotAnnounced	Exception thrown by the (4.9) {@link RTIambassador#synchronizationPointAchieved synchronizationPointAchieved} method when the specified synchronization point was not previously announced.
TimeConstrainedAlreadyEnabled	Exception thrown by the (8.5) {@link RTIambassador#enableTimeConstrained enableTimeConstrained} method when time-constraint is already enabled.
TimeConstrainedIsNotEnabled	Exception thrown by the (8.7) {@link RTIambassador#disableTimeConstrained disableTimeConstrained} method when time-constraint is already disabled.

<exception_name>	**<exception_description>**
TimeRegulationAlreadyEnabled	Exception thrown by the (8.2) {@link RTIambassador#enableTimeRegulation enableTimeRegulation} method when time-regulation is already enabled.
TimeRegulationIsNotEnabled	Exception thrown by the (8.4) {@link RTIambassador#disableTimeRegulation disableTimeRegulation}, (8.19/8.20) {@link RTIambassador#modifyLookahead modifyLookahead}, {@link RTIambassador#queryLookahead queryLookahead} and (8.21) {@link RTIambassador#retract retract} methods when time-regulation is (already) disabled.
UnableToPerformSave	Exception that should be thrown by the (4.12) {@link FederateAmbassador#initiateFederateSave initiateFederateSave} (both forms) callback if the federate considers itself unable to proceed into the Saving state. <p> This exception should be thrown if a quick check by the federate leads it to conclude that an attempt to save is doomed to failure. Normally, the federate will start its save operation and later report success or failure through the (4.14) RTIambassador.federateSave {@link RTIambassador#federateSaveNotComplete [Not]} {@link RTIambassador#federateSaveComplete Complete} methods.
UnknownName	Exception that should be thrown by the (6.3) {@link FederateAmbassador#objectInstanceNameReservationSucceeded objectInstanceNameReservationSucceeded} and {@link FederateAmbassador#objectInstanceNameReservationFailed objectInstanceNameReservationFailed} callbacks if the federate wishes to repudiate the name.

```
// File: InvalidLogicalTimeInterval.java
package hla.rti1516;  //the package name was changed by DoD
Interpretations of IEEE 1516-2000v2

/**
 * NOTE: This exception is NOT part of IEEE 1516-2000 nor
 * specified by the DoD Interpretations; it is tentatively added
 * based on an analysis of apparent inconsistencies between the
 * Java, Ada and C++ specification clauses and normative annexes.
 * <p>
 * Exception thrown by the <code>LogicalTimeInterval.setTo</code>
 * and {@link LogicalTimeInterval#subtract subtract} methods when
 * the supplied <code>LogicalTimeInterval</code> is invalid or
 * would result in an invalid one.
 * @author  Daniel U. Thibault
 * @version 1516.1.5 (DoD v2+1)
 */
public final class
InvalidLogicalTimeInterval
   extends RTIexception
{
   /**
    * Constructs a new exception with the specified detail message.
    * The cause is not initialized, and may subsequently be
initialized by a call to
    * {@link java.lang.Throwable#initCause(java.lang.Throwable)}.
    * @param msg a {@link java.lang.String} holding the detail
message, which can be later retrieved by the {@link
java.lang.Throwable#getMessage} method
    */
   public
   InvalidLogicalTimeInterval (String msg)
   {
      super(msg);
   }
}
//end InvalidLogicalTimeInterval
```

Annex C – DRDC HLA 1516 OMT Supporting Classes

The ca.gc.drdc_rddc.hla.rti1516.omt package implements the 1516.2-2000 Object Model Template (OMT) datatypes and their predefined encodings, as laid out in 4.12. Although a federation is free to define arbitrary data representation schemes for federate-to-federate interaction parameters and object attribute values, the RTI-owned objects and the RTI-issued interactions follow the 1516.2 predefined encodings. The standard currently provides no support whatsoever, but this may hopefully change with later editions. In the meantime, it is hoped the supporting classes laid out herein will prove flexible enough to fill the need.

HLA recognises five broad categories of datatypes: basic, simple, enumerated, array and record. In what follows, we'll examine each set of classes briefly, and outline how user-defined classes should be implemented to follow the design patterns established here. The mandated datatypes and those added by the Management Object Model (MOM) were discussed in Annex A's Encoding/Decoding Values sub-heading.

Basic datatypes

The basic datatypes are the underpinnings of all others, and generally map directly to a given language's primitive types. They represent integers, floating-point numbers and characters, in various byte widths and byte sexes (big or little endian). They also form an almost closed set, in the sense that a federation will rarely have to declare additional basic datatypes.

The basic datatypes map readily to Java's primitive types. We captured the functionality of the datatypes in the HLAdatatype interface, a subset of which is the HLAencodable interface. This facilitates the construction of the more elaborate datatypes later on.

In order to facilitate the construction of user-defined array datatypes, we felt it necessary to add the HLAnull basic datatype. It is trivial to represent, having no width (zero bits) and thus taking up no room in the byte[] representations being ferried around by the RTI.

Simple datatypes

The implementation of the simple datatypes was mostly a matter of casting as broad a net of constructors as possible. Intermediate abstract classes HLAoctetPair, HLAinteger16, HLAinteger32, HLAinteger64, HLAfloat32 and HLAfloat64 capture the behaviour (and underlying storage) common to the big-endian (BE) and little-endian (LE) forms.

Enumerated datatypes

These datatypes describe data elements that can take on a finite discrete set of possible values. They use a basic datatype for internal representation, and are defined by an Enumerator, an exhaustive list of names designating the immutable instance prototypes. The specification allows for a given enumeration member to take on multiple values (for example, the `HLAboolean` value `HLAtrue` could have been defined as "not zero"). This causes a number of problems, so we've chosen to restrict each enumeration member to a single value (although constructors may accept a wider range of input values). Also, the specification does not mention whether enumerated types are ordered or not. We chose here to assume the enumeration sequence is fixed and ordered.

The additional functionality of the enumerated datatypes is captured in the `HLAenumerateddatatype` interface, which extends `HLAdatatype` by adding a couple of `Iterator` members.

In order to simplify as much as possible the task of creating new federation-specific enumerated datatypes, we implemented an `HLAenumeratedIterator` class that automates, using Java object reflection, the task of giving the class an `Iterator` interface. Although it has not been done here, adding an immutable static `List` member to each class would facilitate normalization and unnormalization considerably.

Three of the MOM-defined enumerated datatypes map directly to IEEE 1516 classes: `HLAresignAction (ResignAction)`, `HLAorderType (OrderType)`, and `HLAserviceGroupName (ServiceGroup)`. It should be a very simple matter to modify the implementations given here in order to allow constructors to accept the mapped objects as inputs (e.g. it should be possible to write `HLAserviceGroupName sgn_ss = new HLAserviceGroupName(ServiceGroup.SUPPORT_SERVICES)`.

Array datatypes

These datatypes describe indexed homogeneous collections of datatypes. The collection's size is either fixed or variable, and the elements that make them up are all of the same datatype: simple, enumerated, array or record.

The additional functionality of the array datatypes is captured in the `HLAarraydatatype` interface, which extends `HLAdatatype` and `List`. Common behaviour is again taken care of by ancestor abstract classes, in a two-tier structure (`HLAarrayType` and its descendents `HLAvariableArrayType` and `HLAfixedArrayType`). The implementation provides a concrete class, `HLAobjectArray`, which provides most of the behaviour required of non-trivial variable array types.

Fixed record datatypes

These datatypes describe heterogeneous collections of datatypes. The individual elements (considered to appear in a fixed sequence) are potentially each of a different datatype: simple, enumerated, array or record.

The additional functionality of the fixed record datatypes is captured in the `HLAfixedrecorddatatype` interface, which extends `HLAdatatype` and `Map`. Common behaviour is again taken care of by an ancestor abstract class, `HLAfixedRecordType`, which relies on `HLAfixedRecordIterator` to automate the construction of `Iterator`s, in a manner analogous to enumerated datatypes.

Variant record datatypes

These datatypes describe discriminated unions of datatypes. They are characterised by a discriminant, an enumerated datatype value which is used to switch the interpretation of the record's contents between a number of alternatives. Each alternative is either null (absent) or some other datatype: simple, enumerated, array or record.

The additional functionality of the variant record datatypes is captured in the `HLAvariantrecorddatatype` interface, which extends `HLAdatatype`. Common behaviour is again taken care of by an ancestor abstract class, `HLAvariantRecordType`.

The ByteWrapper class is the workhorse of the package; it implements all of the encoding and decoding behaviours.

```
// File: ByteWrapper.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

/**
 * Utility class for managing data in byte arrays.
 * <p>
 * It is similar to java.nio.ByteBuffer but considerably simpler. The
key components are:
 * <ul>
 * <li>A backing store (returned by the array() method), which is
 * either a wrapped pre-existing byte[] or a newly created one.</li>
 * <li>An inclusive lower bound (returned by the lowerBound() method),
which is
 * the zero-based index of the first accessible byte.</li>
 * <li>An exclusive upper bound (returned by the upperBound() method),
which is
 * the zero-based index of the byte before which the last accessible
byte lies.</li>
 * <li>A cursor, (returned by the pos() method), which is
 * the zero-based index of the current byte (i.e. the next byte to
read or write).
 * The cursor always lies between the lower bound (included) and the
upper bound (included).
 * When the ByteWrapper is created, its cursor is always set to the
lower bound.</li>
 * </ul>
 * <p>
 * Typical use:
 * <ul><code>
 * //To encode an HLA data type into a byte array,<br>
 * //we can get the byte array directly through the toByteArray()
method:<br>
 * HLAinteger32BE pre = new HLAinteger32BE(MY_NUMBER);<br>
 * //final byte[] bytes = pre.toByteArray();<br>
 * //<br>
 * //A ByteWrapper is more flexible, though, since we can use it to
serially encode values into it<br>
 * ByteWrapper bw = new ByteWrapper(pre1.encodedLength() +
pre2.encodedLength());<br>
 * pre1.encode(bw);<br>
 * pre2.encode(bw);<br>
 * //Extract the byte[] representation<br>
 * final byte[] bytes = bw.array();<br>
 * //<br>
 * //To decode an HLA data type from a byte array<br>
 * ByteWrapper bw = new ByteWrapper(bytes);<br>
 * HLAinteger32BE post = new HLAinteger32BE(); //default value of
zero<br>
 * post.decode(bw);<br>
 * //Alternately, decode directly from the byte array...<br>
 * HLAinteger32BE post = new HLAinteger32BE(bytes);<br>
 * //...or the byte wrapper<br>
 * HLAinteger32BE post = new HLAinteger32BE(bw);<br>
 * </code></ul>
 * @author  Mikael Karlsson ({@link http://www.pitch.se Pitch AB}) and
{@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U. Thibault}
({@link http://www.valcartier.drdc-rddc.gc.ca DRDC Valcartier})
 * @version 1.1
 */
public class
ByteWrapper
   implements java.lang.Cloneable
{
   private byte[] _buffer;
   private int _lowerBound;
   private int _upperBound;
   private int _pos;

   /**
    * Constructs a new ByteWrapper backed by a new byte array of the
specified length.
    * Lower bound will be zero, upper bound will be length.
    * The entire array is read/write enabled.
    * @param length the size (in bytes) of the byte[] to create to
back the new ByteWrapper
    */
   public
   ByteWrapper(int length)
   {
      this(new byte[length]); //exception if length zero?
   }

   /**
    * Constructs a new ByteWrapper backed by the specified pre-
existing byte[] buffer.
    * Lower bound will be zero, upper bound will be the buffer.length.
    * (Changes to the Byte Wrapper will write through to buffer)
    * The entire array is read/write enabled.
    * @param buffer the byte[] to use to back the new ByteWrapper
    */
   public
   ByteWrapper(byte[] buffer)
   {
      this(buffer, 0, buffer.length);
   }
   /**
    * Constructs a new ByteWrapper backed by the specified pre-
existing byte[] buffer and
    * specifies the buffer's lower bound.
    * Upper bound will be the buffer.length.
    * (Changes to the Byte Wrapper will write through to buffer)
    * The array is read/write enabled from the lower bound (included)
to the upper bound (excluded).
    * @param buffer the byte[] to use to back the new ByteWrapper
    * @param lowerBound the first accessible position within the
byte[]
    * @throws ArrayIndexOutOfBoundsException if the lowerBound is
greater than the buffer.length
    */
   public
   ByteWrapper(byte[] buffer, int lowerBound)
   {
      this(buffer, lowerBound, buffer.length);
   }

   /**
    * Constructs a new ByteWrapper backed by the specified pre-
existing byte[] buffer and
    * specifies the buffer's lower and upper bounds.
    * (Changes to the Byte Wrapper will write through to buffer)
    * The array is read/write enabled from the lower bound (included)
to the upper bound (excluded).
    * @param buffer the byte[] to use to back the new ByteWrapper
    * @param lowerBound the first accessible position within the
byte[]
    * @param upperBound the position within the byte[] before which
the last accessible byte lies
    * @throws ArrayIndexOutOfBoundsException if the lowerBound is
greater than the upperBound or if the upperBound is greater than the
buffer.length
    */
   public
   ByteWrapper(byte[] buffer, int lowerBound, int upperBound)
   {
      _buffer = buffer;
      _lowerBound = lowerBound;
      _pos = _lowerBound;
      _upperBound = upperBound;
      if (_upperBound > buffer.length) throw new
ArrayIndexOutOfBoundsException(_upperBound);
      verify(0);
   }
   /**
    * Constructs a new ByteWrapper from the specified AttributeHandle
Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the AttributeHandle to encode into the new ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.AttributeHandle o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }

   /**
    * Constructs a new ByteWrapper from the specified DimensionHandle
Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the DimensionHandle to encode into the new ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.DimensionHandle o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }
   /**
    * Constructs a new ByteWrapper from the specified FederateHandle
Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the FederateHandle to encode into the new ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.FederateHandle o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }

   /**
    * Constructs a new ByteWrapper from the specified
InteractionClassHandle Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the InteractionClassHandle to encode into the new
ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.InteractionClassHandle o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }
   /**
    * Constructs a new ByteWrapper from the specified LogicalTime
Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the LogicalTime to encode into the new ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.LogicalTime o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }

   /**
    * Constructs a new ByteWrapper from the specified
LogicalTimeInterval Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the LogicalTimeInterval to encode into the new
ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.LogicalTimeInterval o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }
   /**
    * Constructs a new ByteWrapper from the specified
ObjectClassHandle Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the ObjectClassHandle to encode into the new
ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.ObjectClassHandle o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }

   /**
    * Constructs a new ByteWrapper from the specified
ObjectInstanceHandle Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the ObjectInstanceHandle to encode into the new
ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.ObjectInstanceHandle o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }
   /**
    * Constructs a new ByteWrapper from the specified OrderType
Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the OrderType to encode into the new ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.OrderType o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }

   /**
    * Constructs a new ByteWrapper from the specified ParameterHandle
Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the ParameterHandle to encode into the new ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.ParameterHandle o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }
   /**
    * Constructs a new ByteWrapper from the specified
TransportationType Object.
    * This is a convenience constructor, provided to facilitate using
this HLA object.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the TransportationType to encode into the new
ByteWrapper
    */
   public
   ByteWrapper(hla.rti1516.TransportationType o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }

   /**
    * Constructs a new ByteWrapper from the specified HLAencodable
Object.
    * This is a convenience constructor, provided to facilitate using
the HLA objects.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * @param o the HLAencodable Object to encode into the new
ByteWrapper
    */
   public
   ByteWrapper(HLAencodable o)
   {
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      //Now we can pass this to the (byte[]) constructor:
//    this(bytes);
      //Which passes it to the (byte[], int, int) constructor:
//    this(bytes, 0, bytes.length);
      //Which does:
      _lowerBound = 0;
      _pos = _lowerBound;
      _upperBound = bytes.length;
      verify(0);
   }
   /**
    * Constructs a new ByteWrapper from the specified Object, which is
presumed to have
    * the encode(byte[] buffer, int offset) and encodedLength()
methods.
    * This is a convenience constructor, provided to facilitate using
the HLA objects.
    * Lower bound will be zero, upper bound will be the encodedLength.
    * The entire array is read/write enabled.
    * <p>
    * Things would be an awful lot simpler if IEEE 1516 specified an
Encodable interface
    * consisting of those two methods (see the constructor that
precedes this one).
    * @param o the Object to encode into the new ByteWrapper

   public
   ByteWrapper(Object o)
//    throws IllegalArgumentException //if the Object does not support
the encode and encodedLength methods
   {
      try
      {
         java.lang.reflect.Method eL =
o.getClass().getMethod("encodedLength", null);
         //throws NoSuchMethodException, SecurityException
         final byte[] bytes = new byte[((Integer)(eL.invoke(o,
null))).intValue()];
         java.lang.reflect.Method e = o.getClass().getMethod("encode",
new Class[] { byte[].class, int.class });
         e.invoke(o, new Object[] { bytes, new Integer(0) });
         //throws IllegalAccessException, IllegalArgumentException,
InvocationTargetException

         //The rest wouldn't need to be inside the try if it weren't
for bytes being local to it
         //Now we can pass this to the (byte[]) constructor:
//       this(bytes);
         //Which passes it to the (byte[], int, int) constructor:
//       this(bytes, 0, bytes.length);
         //Which does:
         _lowerBound = 0;
         _pos = _lowerBound;
         _upperBound = bytes.length;
         verify(0);
      } catch (Exception ex) {
         //For some unfathomable reason, throwing this here and
declaring it above does not compile.
         //Since all HLA objects do support HLAencodable, it cannot
occur anyway.
//       throw new
IllegalArgumentException(ex.getLocalizedMessage()).initCause(ex);
      }
   }
    */
   /**
    * Returns the complete backing array.
    * The returned array runs from zero to length, not just from the
lower to the upper bound.
    * @return the complete byte[] backing the ByteWrapper
    */
   public final byte[]
   array()
   {
      return _buffer;
   }

   /**
    * Returns the lower bound.
    * @return the ByteWrapper's lower bound
    */
   public final int
   lowerBound()
   {
      return _lowerBound;
   }

   /**
    * Returns the upper bound.
    * @return the ByteWrapper's upper bound
    */
   public final int
   upperBound()
   {
      return _upperBound;
   }

   /**
    * Returns the current position.
    * @return the current read/write position of the ByteWrapper
    */
   public final int
   pos()
   {
      return _pos;
   }

   /**
    * Resets the current position to the first accessible byte (the
lower bound) of the ByteWrapper.
    */
   public void
   reset()
   {
      _pos = _lowerBound;
   }
   /**
    * Throws an exception if there aren't at least <code>length</code>
accessible bytes from the current position onward.
    * In other words, verifies that the current position plus
<code>length</code> does not overshoot the upper bound.
    * @param length the length to verify the ByteWrapper for, measured
from the current position
    * @throws ArrayIndexOutOfBoundsException if the current position
plus length is beyond the upperBound of the ByteWrapper
    */
   private final void
   verify(int length)
   {
      if ((_pos + length) > _upperBound) throw new
ArrayIndexOutOfBoundsException(_pos + length);
   }

   /**
    * Gets the next n bytes (a power of two, normally) from the
wrapped byte array
    * as a big-endian 64-bit integer.
    * The ByteWrapper's current position is increased by n.
    * @param n the number of bytes to get
    * @param bigendian whether the source bytes are in big-endian
order or not
    * @return a long decoded value
    * @throws IllegalArgumentException if n is not within the 0..8
range
    * @throws ArrayIndexOutOfBoundsException if there are not at least
n bytes left in the wrapped byte array
    */
   private long
   getBytes(int     n,
            boolean bigendian)
      throws IllegalArgumentException
   {
      if ((n < 0) || (n > 8)) throw new
IllegalArgumentException(Integer.toString(n));
      verify(n);
      long value = 0;
      if (bigendian)
      {
         for (int nn = n - 1; nn >= 0; nn--)
            value += (_buffer[_pos++] & 0x00FFL) << (8*nn);
      }
      else
      {
         for (int nn = 0; nn < n; nn++)
            value += (_buffer[_pos++] & 0x00FFL) << (8*nn);
      }
      return value;
   }
   /**
    * Gets the next eight bytes from the wrapped byte array as a big-
endian 64-bit integer.
    * The ByteWrapper's current position is increased by 8.
    * @return a long decoded value
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to make up a long
    */
   public final long
   getLong()
   {
      return getBytes(8, true);
   }

   /**
    * Gets the next eight bytes from the wrapped byte array as a
little-endian 64-bit integer.
    * The ByteWrapper's current position is increased by 8.
    * @return a long decoded value
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to make up a long
    */
   public final long
   getLongLE()
   {
      return getBytes(8, false);
   }

   /**
    * Gets the next four bytes from the wrapped byte array as a big-
endian 32-bit integer.
    * The ByteWrapper's current position is increased by 4.
    * @return an int decoded value
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to make up an int
    */
   public final int
   getInt()
   {
      return (int)getBytes(4, true);
   }

   /**
    * Gets the next four bytes from the wrapped byte array as a
little-endian 32-bit integer.
    * The ByteWrapper's current position is increased by 4.
    * @return an int decoded value
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to make up an int
    */
   public final int
   getIntLE()
   {
      return (int)getBytes(4, false);
   }
   /**
    * Gets the next two bytes from the wrapped byte array as a big-
endian 16-bit integer.
    * The ByteWrapper's current position is increased by 2.
    * @return a short decoded value
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to make up a short
    */
   public final short
   getShort()
   {
      return (short)getBytes(2, true);
   }

   /**
    * Gets the next two bytes from the wrapped byte array as a little-
endian 16-bit integer.
    * The ByteWrapper's current position is increased by 2.
    * @return a short decoded value
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to make up a short
    */
   public final short
   getShortLE()
   {
      return (short)getBytes(2, false);
   }

   /**
    * Gets the next two bytes from the wrapped byte array as an
unsigned 16-bit char.
    * The ByteWrapper's current position is increased by 2.
    * @return a char decoded value
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to make up a char
    */
   public final char
   getChar()
   {
      return (char)getBytes(2, true);
   }

   /**
    * Gets the next byte from the wrapped byte array.
    * The ByteWrapper's current position is increased by 1.
    * @return an int decoded value (representing a single byte)
    * @throws ArrayIndexOutOfBoundsException if there isn't at least
one byte left in the wrapped byte array
    */
   public final byte
   getByte()
   {
//    return (byte)getBytes(1, true);
      verify(1);
//    return (_buffer[_pos++] & 0xFF);
      return _buffer[_pos++];
   }
   /**
    * Writes to the specified byte array from the wrapped byte array.
    * The ByteWrapper's current position is increased by dest.length.
    * @param dest the byte[] to fill from the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to fill the dest byte[]
    */
   public final ByteWrapper
   write(byte[] dest)
   {
      verify(dest.length);
      System.arraycopy(_buffer, _pos, dest, 0, dest.length);
      _pos += dest.length;
      return this;
   }

   /**
    * Puts the value into the wrapped byte array; it is n bytes wide
(a power of two, normally)
    * and is big-endian if the boolean is true.
    * @param value a long holding the value to put in
    * @param n the number of bytes to put in
    * @param bigendian whether the value should be written big-endian
or not
    * @throws IllegalArgumentException if n is not within the 0..8
range
    * @throws ArrayIndexOutOfBoundsException if there are not at least
n bytes left in the wrapped byte array
    */
   private void
   putBytes(long    value,
            int     n,
            boolean bigendian)
      throws IllegalArgumentException
   {
      if ((n < 0) || (n > 8)) throw new
IllegalArgumentException(Integer.toString(n));
      verify(n);
      if (bigendian)
      {
         for (int nn = n - 1; nn >= 0; nn--)
            _buffer[_pos++] = (byte)((value >>> (8*nn)) & 0xFF);
      }
      else
      {
         for (int nn = 0;     nn < n;  nn++)
            _buffer[_pos++] = (byte)((value >>> (8*nn)) & 0xFF);
      }
   }
   /**
    * Puts value into the wrapped byte array as a big-endian 64-bit
integer.
    * The ByteWrapper's current position is increased by 8.
    * @param value the long to write to the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to write a long into
    */
   public final ByteWrapper
   putLong(long value)
   {
      putBytes(value, 8, true);
      return this;
   }

   /**
    * Puts value into the wrapped byte array as a little-endian 64-bit
integer.
    * The ByteWrapper's current position is increased by 8.
    * @param value the long to write to the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to write a long into
    */
   public final ByteWrapper
   putLongLE(long value)
   {
      putBytes(value, 8, false);
      return this;
   }

   /**
    * Puts value into the wrapped byte array as a big-endian 32-bit
integer.
    * The ByteWrapper's current position is increased by 4.
    * @param value the int to write to the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to write an int into
    */
   public final ByteWrapper
   putInt(int value)
   {
      putBytes(value, 4, true);
      return this;
   }
   /**
    * Puts value into the wrapped byte array as a little-endian 32-bit
integer.
    * The ByteWrapper's current position is increased by 4.
    * @param value the int to write to the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to write an int into
    */
   public final ByteWrapper
   putIntLE(int value)
   {
      putBytes(value, 4, false);
      return this;
   }

   /**
    * Puts value into the wrapped byte array as a big-endian 16-bit
integer.
    * The ByteWrapper's current position is increased by 2.
    * @param value the short to write to the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to write a short into
    */
   public final ByteWrapper
   putShort(short value)
   {
      putBytes(value, 2, true);
      return this;
   }

   /**
    * Puts value into the wrapped byte array as a little-endian 16-bit
integer.
    * The ByteWrapper's current position is increased by 2.
    * @param value the short to write to the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to write a short into
    */
   public final ByteWrapper
   putShortLE(short value)
   {
      putBytes(value, 2, false);
      return this;
   }
   /**
    * Puts value into the wrapped byte array as an unsigned 16-bit
char.
    * The ByteWrapper's current position is increased by 2.
    * @param value the char to write to the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to write a char into
    */
   public final ByteWrapper
   putChar(char value)
   {
      putBytes(value, 2, true);
      return this;
   }

   /**
    * Puts the byte b into the wrapped byte array.
    * The ByteWrapper's current position is increased by 1.
    * @param b int to put into the wrapped byte array's current byte
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there isn't at least
one byte left in the wrapped byte array to write to
    */
   public final ByteWrapper
   putByte(byte b)
   {
//    putBytes(value, 1, true);
      verify(1);
      _buffer[_pos++] = b;
      return this;
   }

   /**
    * Reads a byte array into the wrapped byte array.
    * The ByteWrapper's current position increases by the array's
size.
    * @param src byte[] to read into the wrapped byte array
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to read the src byte[] into
    */
   public final ByteWrapper
   read(byte[] src)
   {
      verify(src.length);
      System.arraycopy(src, 0, _buffer, _pos, src.length);
      _pos += src.length;
      return this;
   }
   /**
    * Skips n bytes without reading from or writing to them.
    * @param n an int specifying by how many bytes to advance the
current position
    * @return this ByteWrapper
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to skip ahead as requested
    */
   public final ByteWrapper
   skip(int n)
   {
      verify(n);
      _pos += n;
      return this;
   }

   /**
    * Advances the current position until the specified byte alignment
is achieved (typically a power of 2).
    * @param alignment an int specifying what the current position
should be a whole multiple of
    * @throws ArrayIndexOutOfBoundsException if there are not enough
bytes left in the wrapped byte array to align as requested
    */
   public final void
   align(int alignment)
   {
      while ((_pos % alignment) != 0) skip(1);
   }

   /**
    * Creates a new ByteWrapper backed by the same byte array but
using the current position as its lower bound.
    * The upper bound is inherited.
    * @return a new ByteWrapper backed by the same byte[] and whose
lower bound is the current position
    */
   public final ByteWrapper
   slice()
   {
      return new ByteWrapper(_buffer, _pos, _upperBound);
   }
   /**
    * Creates a new ByteWrapper backed by the same byte array but
using the current
    * position as its lower Bound and the specified length to mark the
upper bound.
    * @param length an int specifying the new ByteWrapper's upper
bound, measured from the current position
    * @return a new ByteWrapper backed by the same byte[], but whose
accessible bytes run from the current position (included) to length
bytes further
    * @throws ArrayIndexOutOfBoundsException if there are not at least
length bytes left in the ByteWrapper
    */
   public final ByteWrapper
   slice(int length)
   {
      verify(length);
      return new ByteWrapper(_buffer, _pos, _pos + length);
   }

   //java.lang.Object methods

   /**
    * Creates and returns a copy of this object.
    * The cloned Object will be backed by a copy of the original
byte[].
    * @return an independent copy of this Object
    * @throws CloneNotSupportedException if the object's class is not
Cloneable or if the instance cannot be cloned
    */
   public Object
   clone()
      throws CloneNotSupportedException
   {
//    throw new CloneNotSupportedException();
      ByteWrapper theClone = new ByteWrapper(_buffer.length);
      theClone._lowerBound = this._lowerBound;
      theClone._pos        = this._pos;
      theClone._upperBound = this._upperBound;
      System.arraycopy(this._buffer, 0, theClone._buffer, 0,
theClone._buffer.length);
      return theClone;
//    return (Object)theClone;
   }
```

```
    /**
     * Compares the specified object with this one for equality.
     * Returns <tt>true</tt> if and only if the specified object is
also a
     * ByteWrapper (or descendant), and both have the same backing
store and bounds.
     * @param obj the Object to be compared for equality with this one
     * @return <tt>true</tt> if the specified Object is equal to this
one
     */
   public boolean
   equals(Object obj)
   {
      //The java.lang.Object implementation is simply:
//    return (this == obj);

      //Trivial case: both this and obj are references to the same
object
      if (obj == this) return true;

      //obj must be an instance of this class or a descendant.
      //However, we do NOT want sibling classes to be "equal".
      //If we did this:
//    if (!(obj instanceof ByteWrapper)) return false;
      //Then two sibling classes (that descend from ByteWrapper along
diverging paths)
      //would nevertheless be considered equal since their inherited
equals()
      //would compare them to their common super-class, ByteWrapper.

      //Doing this:
//    if (! this.getClass().isInstance(obj)) return false;
      //Insures that obj's class descends from this' class, but the
method is then not symmetric
      //So we match the classes instead:
      if (! this.getClass().equals(obj.getClass())) return false;

      //So far so good; now compare relevant fields
      return ((_buffer     == ((ByteWrapper)obj).array()        ) &&
              (_lowerBound == ((ByteWrapper)obj).lowerBound()) &&
              (_upperBound == ((ByteWrapper)obj).upperBound())    );
      //The cursor (i.e. _pos vs obj.pos()) is not relevant
   }
}
//end ByteWrapper
```

The `HLAencodable` interface is supported by just about all HLA objects.

```
// File: HLAencodable.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

/**
 * Interface which just about all HLA interfaces and object types
support.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public interface
HLAencodable
{
   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength();

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    * @return how many bytes were written to the buffer, including any
prefix padding bytes
    */
   public int
   encode(byte[] buffer,
          int    offset);
}
//end HLAencodable
```

The `HLAdatatype` interface is the minimal one supported by all HLA datatypes.

```
// File: HLAdatatype.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Interface implemented by the various HLA data types.
 * <p>
 * In addition to this interface, the HLA data type classes are
expected to supply:
 * <ul>
 * <li> Constructors (default and specified-value)</li>
 * <li> Constructor (byte[] buffer) throws CouldNotDecode</li>
 * <li> Constructor (byte[] buffer, int offset) throws
CouldNotDecode</li>
 * <li> Constructor (ByteWrapper byteWrapper) throws
CouldNotDecode</li>
 * <li> java.lang.Object methods toString(); equals(Object
otherObject) and hashCode()</li>
 * <li> Class-specific extensions to get and set the value as a basic
Java data type (int, boolean, etc.)</li>
 * </ul>
 * Note that even though encodedLength (sometimes) and octetBoundary
(always) could be static methods, Java forbids an
 * interface method from being static, and also forbids an interface
method implementation from being static.
 * This is because static invocation mode isn't like virtual
invocation mode in the sense that the method invoked will be the
 * *local* one instead of the run-time class'.  For example, suppose
XX descends from X, and that X defines methods M and MM.
 * XX overrides MM but not M.  When XX.M is invoked, its resolution is
passed to X.M.  If MM is non-static, then a
 * (virtual) invocation of MM by X.M will invoke XX.MM.  If MM is
static, on the other hand, then a (static) invocation of MM by
 * X.M will invoke X.MM instead.  Thus, to ensure proper polymorphism
one must not use static methods.
 * <p>
 * Nevertheless, to allow obtaining a class' octetBoundary and/or
encodedLength, when these are defined at the class level, one
 * need only declare (public static final) *fields* of those names.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
```

```
public interface
HLAdatatype
   extends HLAencodable
{
   /**
    * As a general rule, Variant Records [HLAvariantRecord], Dynamic
Arrays [HLAvariableArray], and any
    * Fixed Arrays [HLAfixedArray] or Fixed Records [HLAfixedRecord]
containing either of these first two
    * cannot have a constant encodedLength.
    */

   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * <p>
    * In all cases, octetBoundary is constant.
    * @return the octet boundary of <code>this</code>
    */
   int
   octetBoundary();

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   ByteWrapper
   encode(ByteWrapper byteWrapper);

   /**
    * Encodes <code>this</code> into a new <code>byte[]</code>.
    * @return a <code>byte[]</code> encoding <code>this</code>
    */
   byte[]
   toByteArray();

   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the data type
    * @return how many bytes were read from the <code>byte[]</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer)
      throws CouldNotDecode;
   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> <code>this</code>
representation begins
    * @return where in the <code>buffer</code> <code>this</code>
representation ends
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode;

   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode;
}
//end HLAdatatype
```

The HLAbasicType abstract class regroups behaviour common to the HLA basic datatypes.

```
// File: HLAbasicType.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Abstract ancestor for the type-safe simple and basic data types.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAbasicType
   implements java.io.Serializable,
              java.lang.Cloneable,
              HLAdatatype
{
   //HLAdatatype interface implementation

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    * @return how many bytes were written to the buffer, including any
prefix padding bytes
    */
   public int
   encode(byte[] buffer,
          int    offset)
   {
      return encode(new ByteWrapper(buffer, offset)).pos() - offset;
   }

   /**
    * Encodes <code>this</code> into a new <code>byte[]</code>.
    * @return a <code>byte[]</code> encoding <code>this</code>
    */
   public byte[]
   toByteArray()
   {
      return encode(new ByteWrapper(encodedLength())).array();
   }
   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @return how many bytes were read from the <code>byte[]</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer)
      throws CouldNotDecode
   {
      return decode(buffer, 0);
   }

   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> <code>this</code>
representation begins
    * @return where in the <code>buffer</code> <code>this</code>
representation ends
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode
   {
      try
      {
         return decode(new ByteWrapper(buffer, offset)).pos();
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   //Cloneable implementation

   /**
    * Creates and returns a copy of this object.
    * @return an independent copy of this Object
    * @throws CloneNotSupportedException if the object's class is not
Cloneable or if the instance cannot be cloned
    */
   public Object
   clone()
      throws CloneNotSupportedException
   {
//    throw new CloneNotSupportedException();
      return super.clone();
   }
}
//end HLAbasicType
```

The next twenty classes implement the HLA basic datatypes, including our `HLAnull` addition.

The pattern is constant: each class declares a protected value-holder field, final static fields for `encodedLength` and `octetBoundary`, then the constructors (default, class-specific, `byte[]`, `byte[]` with offset, `ByteWrapper`), and the `java.lang.Object` methods `toString`, `equals` and `hashCode`. Next, the `HLAdatatype` interface, already partially implemented by `HLAbasicType`, is completed: the `encodedLength` and `octetBoundary` methods simply reflect the static fields (something which the more complex datatypes cannot do), and the `encode(ByteWrapper)` and `decode(ByteWrapper)` methods (which `HLAbasicType` delegates to) are supplied. Finally, any class-specific extensions (`get/setValue`) are added.

Each of the big-endian/little-endian datatype pairs is implemented first through an abstract class that regroups common fields and methods.

```
// File: HLAnull.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe null basic data type.
 * <p>
 * <code>HLAnull</code> is not part of the HLA spec; it is used only
to make the HLAobjectArray class
 * concrete by providing a zero-size implementation of HLAdatatype.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAnull
   extends HLAbasicType
{
   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 0;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 1;
   /**
    * Constructs a <code>HLAnull</code>.
    */
   public
   HLAnull()
   {
      //super() not called because super-class is abstract
   }

   /**
    * Creates a <code>HLAnull</code> from the network representation
in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAnull</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAnull(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAnull</code> from the network representation
in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAnull</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAnull</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAnull(byte[] buffer,
           int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAnull</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAnull</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAnull(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return "null";
   }

   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      //This form is more inheritable: match classes
      return this.getClass().equals(otherObject.getClass());
   }
   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return 0;
   }

   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }

   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary()); //Won't move cursor
      return byteWrapper; //No change
   }
   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary()); //Won't move
         return byteWrapper; //No change
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
}
//end HLAnull
```

```
// File: HLAoctet.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 8-bit byte basic data type.
 * <p>
 * <code>HLAoctet</code>s are normally never obtained directly, as the
RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAoctetFactory</code>'s decode method on a <code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAoctet
   extends HLAbasicType
{
   /** The 8-bit byte value: a Java byte. */
   protected byte _value;

   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 1;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 1;

   /**
    * Constructs a <code>HLAoctet</code> of default value (zero).
    */
   public
   HLAoctet()
   {
      //super() not called because super-class is abstract
      //Default _value is zero
   }

   /**
    * Constructs a <code>HLAoctet</code> of the specified value.
    * @param value a byte specifying <code>this</code>' value
    */
   public
   HLAoctet(byte value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAoctet</code> from the network representation
in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAoctet</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAoctet(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAoctet</code> from the network representation
in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAoctet</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAoctet</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAoctet(byte[] buffer,
            int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAoctet</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAoctet</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAoctet(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Byte.toString(getValue());
   }

   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
//    if (!(otherObject instanceof HLAoctet)) return false;
//    final HLAoctet other = (HLAoctet)otherObject;
//    return (getValue() == other.getValue());
      //This form is more inheritable: first, match the classes
      if (! this.getClass().equals(otherObject.getClass())) return
false;
      return (getValue() == ((HLAoctet)otherObject).getValue());
   }

   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return new Byte(getValue()).hashCode();
   }
   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }

   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      return byteWrapper.putByte(getValue());
   }
   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         setValue(byteWrapper.getByte());
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   //Class-specific extensions

   /**
    * Returns the byte value of <code>this</code>.
    * @return the byte value of <code>this</code>
    * @see #setValue
    */
   public byte
   getValue()
   {
      return _value;
   }

   /**
    * Sets the byte value of <code>this</code>.
    * @param value the byte new value for <code>this</code>
    * @see #getValue
    */
   public void
   setValue(byte value)
   {
      _value = value;
   }
}
//end HLAoctet
```

```
// File: HLAoctetPair.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Abstract type-safe 16-bit octet-pair basic data type.
 * It uses the <code>char</code> Java type (an unsigned 16-bit
integer) to store the value
 * and is the ancestor of the HLAoctetPairBE and HLAoctetPairLE
concrete classes.
 * <p>
 * Note that HLAoctetPair is the only data type to actually store the
unmodified byte sequence;
 * all other types instead store the value represented by the byte
sequence.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAoctetPair
   extends HLAbasicType
{
   /**
    * The 16-bit octet-pair value: a Java char.
    * As an unsigned 16-bit, the bytes will be in appropriate endian
order.
    */
   protected char _value;

   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 2;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 2;
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      String s = "0x";
      if (getFirstByte() < 0x0010) s = s + "0";
      s = s + Integer.toHexString(getFirstByte());
      s = s + " 0x";
      if (getSecondByte() < 0x0010) s = s + "0";
      s = s + Integer.toHexString(getSecondByte());
      return s;
   }

   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      if (! this.getClass().equals(otherObject.getClass())) return
false;
//    if (this.isBigEndian() !=
((HLAoctetPair)otherObject).isBigEndian()) return false;
      return (getValue() == ((HLAoctetPair)otherObject).getValue());
   }

   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return new Character(getValue()).hashCode();
   }
   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }

   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      return byteWrapper.putChar(getValue());
   }
   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         setValue(byteWrapper.getChar());
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   //Class-specific extensions

   /**
    * Returns the char value of <code>this</code>.
    * The char's bytes will be in the appropriate endian order;
    * in other words, returns the unmodified byte sequence.
    * @return the char value of <code>this</code>
    * @see #setValue
    */
   protected char
   getValue()
   {
      return _value;
   }

   /**
    * Returns the first byte value of <code>this</code>.
    * @return the first byte value of <code>this</code>
    * @see #setFirstByte
    */
   public byte
   getFirstByte()
   {
      return (byte)(_value >>> 8); // >>> is right-shift with zero-
extension
   }
   /**
    * Returns the second byte value of <code>this</code>.
    * @return the second byte value of <code>this</code>
    * @see #setSecondByte
    */
   public byte
   getSecondByte()
   {
      return (byte)(_value & 0x00FF);
   }

   /**
    * Returns the high byte value of <code>this</code>.
    * @return the high byte value of <code>this</code>
    * @see #setHighByte
    */
   public byte
   getHighByte()
   {
      return ( isBigEndian() ? getFirstByte() : getSecondByte() );
   }

   /**
    * Returns the low byte value of <code>this</code>.
    * @return the low byte value of <code>this</code>
    * @see #setLowByte
    */
   public byte
   getLowByte()
   {
      return ( isBigEndian() ? getSecondByte() : getFirstByte() );
   }

   /**
    * Sets the char value of <code>this</code>.
    * The char's bytes will be stored in unmodified sequence;
    * in other words, the char should be the appropriate-endian
representation of the octet pair.
    * @param value the char new value for <code>this</code>
    * @see #getValue
    */
   protected void
   setValue(char value)
   {
      _value = value;
   }
   /**
    * Sets the first byte value of <code>this</code>.
    * @param firstByte the new byte value for <code>this</code>' first
byte
    * @see #getFirstByte
    */
   public void
   setFirstByte(byte firstByte)
   {
      _value = (char)((_value & 0x00FF) | ( ((int)firstByte) << 8 ));
   }

   /**
    * Sets the second byte value of <code>this</code>.
    * @param secondByte the new byte value for <code>this</code>'
second byte
    * @see #getSecondByte
    */
   public void
   setSecondByte(byte secondByte)
   {
      _value = (char)((_value & 0xFF00) | secondByte);
   }

   /**
    * Sets the high byte value of <code>this</code>.
    * @param highByte the new byte value for <code>this</code>' high
byte
    * @see #getHighByte
    */
   public void
   setHighByte(byte highByte)
   {
      if (isBigEndian()) { setFirstByte(highByte); } else {
setSecondByte(highByte); }
   }

   /**
    * Sets the low byte value of <code>this</code>.
    * @param lowByte the new byte value for <code>this</code>' low
byte
    * @see #getLowByte
    */
   public void
   setLowByte(byte lowByte)
   {
      if (isBigEndian()) { setSecondByte(lowByte); } else {
setFirstByte(lowByte); }
   }
   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public abstract boolean
   isBigEndian();
   //If we declare isBigEndian() static, it won't work: static
invocation mode isn't like virtual invocation mode in the sense
   //that the method invoked will be the *local* one instead of the
run-time class'.  In other words, when a descendant of
   //HLAoctetPair invokes one of the inherited methods defined here,
if isBigEndian is static then HLAoctetPair's isBigEndian
   //will be invoked, not the descendant's...
   //
   //Likewise, we cannot rely on a field, because fields are never
virtual in their invocation mode.
   //Finally, declaring a "blank final" (non-static) field set by the
constructors works for this class but fails for the
   //descendants (which cannot assign to the inherited final).
}
//end HLAoctetPair
```

```
// File: HLAoctetPairBE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 16-bit big-endian octet-pair basic data type.
 * Note that HLAoctetPair is the only data type to actually store the
unmodified byte sequence;
 * all other types instead store the value represented by the byte
sequence.
 * <p>
 * <code>HLAoctetPairBE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAoctetPairBEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAoctetPairBE
   extends HLAoctetPair
{
   /**
    * Constructs a <code>HLAoctetPairBE</code> of default value (zero
or Unicode null).
    */
   public
   HLAoctetPairBE()
   {
      //super() not called because super-class is abstract
//    setValue('\u0000');
   }

   /**
    * Constructs a <code>HLAoctetPairBE</code> of the specified char
value.
    * @param value a char specifying <code>this</code>' value
    */
   public
   HLAoctetPairBE(char value)
   {
      this();
      setValue(value);
   }
   /**
    * Constructs a <code>HLAoctetPairBE</code> of the specified short
value.
    * The short's bytes are stored in unmodified sequence (thus first
-> high; second -> low).
    * @param value a short specifying <code>this</code>' value
    */
   public
   HLAoctetPairBE(short value)
   {
      this((char)value);
   }

   /**
    * Constructs a <code>HLAoctetPairBE</code> of the specified value,
using high and low bytes.
    * @param highByte a byte specifying the high byte of
<code>this</code>' value
    * @param lowByte a byte specifying the low byte of
<code>this</code>' value
    */
   public
   HLAoctetPairBE(byte highByte,
                  byte lowByte)
   {
      //Note the byte order reversal when compared with HLAoctetPairLE
      this( (char)(( ((int)highByte) << 8 ) | lowByte) );
   }

   /**
    * Creates a <code>HLAoctetPairBE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAoctetPairBE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAoctetPairBE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAoctetPairBE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAoctetPairBE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAoctetPairBE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAoctetPairBE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAoctetPairBE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAoctetPairBE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAoctetPairBE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return true;
   }
}
//end HLAoctetPairBE
```

```
// File: HLAoctetPairLE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 16-bit little-endian octet-pair basic data type.
 * <p>
 * <code>HLAoctetPairLE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAoctetPairLEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAoctetPairLE
   extends HLAoctetPair
{
   /**
    * Constructs a <code>HLAoctetPairLE</code> of default value (zero
or Unicode null).
    */
   public
   HLAoctetPairLE()
   {
      //super() not called because super-class is abstract
//    setValue('\u0000');
   }

   /**
    * Constructs a <code>HLAoctetPairLE</code> of the specified char
value.
    * @param value a char specifying <code>this</code>' value
    */
   public
   HLAoctetPairLE(char value)
   {
      this();
      setValue(value);
   }
   /**
    * Constructs a <code>HLAoctetPairLE</code> of the specified short
value.
    * The short's bytes are stored in unmodified sequence (thus first
-> low; second -> high).
    * @param value a short specifying <code>this</code>' value
    */
   public
   HLAoctetPairLE(short value)
   {
      this((char)value);
   }

   /**
    * Constructs a <code>HLAoctetPairLE</code> of the specified value,
using high and low bytes.
    * @param highByte a byte specifying the high byte of
<code>this</code>' value
    * @param lowByte a byte specifying the low byte of
<code>this</code>' value
    */
   public
   HLAoctetPairLE(byte highByte,
                  byte lowByte)
   {
      //Note the byte order reversal when compared with HLAoctetPairBE
      this( (char)(( ((int)lowByte) << 8 ) | highByte) );
   }

   /**
    * Creates a <code>HLAoctetPairLE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAoctetPairLE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAoctetPairLE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAoctetPairLE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAoctetPairLE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAoctetPairLE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAoctetPairLE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAoctetPairLE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAoctetPairLE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAoctetPairLE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return false;
   }
}
//end HLAoctetPairLE
```

```
// File: HLAinteger16.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Abstract type-safe 16-bit integer basic data type.
 * It uses the <code>short</code> Java type to store the value
 * and is the ancestor of the HLAinteger16BE and HLAinteger16LE
concrete classes.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAinteger16
   extends HLAbasicType
{
   /** The 16-bit integer value: a Java short. */
   protected short _value;

   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 2;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 2;

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Short.toString(getValue());
   }
   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      if (! this.getClass().equals(otherObject.getClass())) return
false;
//    if (this.isBigEndian() !=
((HLAinteger16)otherObject).isBigEndian()) return false;
      return (getValue() == ((HLAinteger16)otherObject).getValue());
   }

   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return new Short(getValue()).hashCode();
   }

   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      return ( isBigEndian() ? byteWrapper.putShort(getValue()) :
byteWrapper.putShortLE(getValue()) );
   }

   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         if (isBigEndian())
         { setValue(byteWrapper.getShort()); }
         else
         { setValue(byteWrapper.getShortLE()); }
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   //Class-specific extensions

   /**
    * Returns the short value of <code>this</code>.
    * @return the short value of <code>this</code>
    * @see #setValue
    */
   public short
   getValue()
   {
      return _value;
   }

   /**
    * Sets the short value of <code>this</code>.
    * @param value the short new value for <code>this</code>
    * @see #getValue
    */
   public void
   setValue(short value)
   {
      _value = value;
   }

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public abstract boolean
   isBigEndian();
}
//end HLAinteger16
```

```
// File: HLAinteger16BE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 16-bit big-endian integer basic data type.
 * It uses the <code>short</code> Java type to store the value.
 * <p>
 * <code>HLAinteger16BE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAinteger16BEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteger16BE
   extends HLAinteger16
{
   /**
    * Constructs a <code>HLAinteger16BE</code> of default value
(zero).
    */
   public
   HLAinteger16BE()
   {
      //super() not called because super-class is abstract
      //Default _value is zero
   }

   /**
    * Constructs a <code>HLAinteger16BE</code> of the specified value.
    * @param value a short specifying <code>this</code>' value
    */
   public
   HLAinteger16BE(short value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAinteger16BE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger16BE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger16BE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAinteger16BE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger16BE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAinteger16BE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger16BE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAinteger16BE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAinteger16BE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteger16BE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return true;
   }
}
//end HLAinteger16BE
```

```
// File: HLAinteger16LE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 16-bit little-endian integer basic data type.
 * It uses the <code>short</code> Java type to store the value.
 * <p>
 * <code>HLAinteger16LE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAinteger16LEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteger16LE
   extends HLAinteger16
{
   /**
    * Constructs a <code>HLAinteger16LE</code> of default value
(zero).
    */
   public
   HLAinteger16LE()
   {
      //super() not called because super-class is abstract
      //Default _value is zero
   }

   /**
    * Constructs a <code>HLAinteger16LE</code> of the specified value.
    * @param value a short specifying <code>this</code>' value
    */
   public
   HLAinteger16LE(short value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAinteger16LE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger16LE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger16LE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAinteger16LE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger16LE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAinteger16LE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger16LE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAinteger16LE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAinteger16LE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteger16LE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return false;
   }
}
//end HLAinteger16LE
```

```
// File: HLAinteger32.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Abstract type-safe 32-bit integer basic data type.
 * It uses the <code>int</code> Java type to store the value (not the
byte sequence).
 * and is the ancestor of the HLAinteger32BE and HLAinteger32LE
concrete classes.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAinteger32
   extends HLAbasicType
{
   /** The 32-bit integer value: a Java int. */
   protected int _value;

   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 4;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 4;

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Integer.toString(getValue());
   }
   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      if (! this.getClass().equals(otherObject.getClass())) return
false;
//    if (this.isBigEndian() !=
((HLAinteger32)otherObject).isBigEndian()) return false;
      return (getValue() == ((HLAinteger32)otherObject).getValue());
   }

   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return new Integer(getValue()).hashCode();
   }

   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      return ( isBigEndian() ? byteWrapper.putInt(getValue()) :
byteWrapper.putIntLE(getValue()) );
   }

   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         if (isBigEndian())
         { setValue(byteWrapper.getInt()); }
         else
         { setValue(byteWrapper.getIntLE()); }
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   //Class-specific extensions

   /**
    * Returns the int value of <code>this</code>.
    * @return the int value of <code>this</code>
    * @see #setValue
    */
   public int
   getValue()
   {
      return _value;
   }

   /**
    * Sets the int value of <code>this</code>.
    * @param value the int new value for <code>this</code>
    * @see #getValue
    */
   public void
   setValue(int value)
   {
      _value = value;
   }

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public abstract boolean
   isBigEndian();
}
//end HLAinteger32
```

```
// File: HLAinteger32BE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit big-endian integer basic data type.
 * It uses the <code>int</code> Java type to store the value (not the
byte sequence).
 * <p>
 * <code>HLAinteger32BE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAinteger32BEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteger32BE
   extends HLAinteger32
{
   /**
    * Constructs a <code>HLAinteger32BE</code> of default value
(zero).
    */
   public
   HLAinteger32BE()
   {
      //super() not called because super-class is abstract
      //Default _value is zero
   }

   /**
    * Constructs a <code>HLAinteger32BE</code> of the specified value.
    * @param value an int specifying <code>this</code>' value
    */
   public
   HLAinteger32BE(int value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAinteger32BE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger32BE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger32BE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAinteger32BE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger32BE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAinteger32BE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger32BE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAinteger32BE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAinteger32BE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteger32BE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return true;
   }
}
//end HLAinteger32BE
```

```
// File: HLAinteger32LE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit little-endian integer basic data type.
 * It uses the <code>int</code> Java type to store the value (not the
byte sequence).
 * <p>
 * <code>HLAinteger32LE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAinteger32LEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteger32LE
   extends HLAinteger32
{
   /**
    * Constructs a <code>HLAinteger32LE</code> of default value
(zero).
    */
   public
   HLAinteger32LE()
   {
      //super() not called because super-class is abstract
      //Default _value is zero
   }

   /**
    * Constructs a <code>HLAinteger32LE</code> of the specified value.
    * @param value an int specifying <code>this</code>' value
    */
   public
   HLAinteger32LE(int value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAinteger32LE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger32LE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger32LE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAinteger32LE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger32LE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAinteger32LE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger32LE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAinteger32LE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAinteger32LE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteger32LE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return false;
   }
}
//end HLAinteger32LE
```

```
// File: HLAinteger64.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Abstract type-safe 64-bit integer basic data type.
 * It uses the <code>long</code> Java type to store the value (not the
byte sequence)
 * and is the ancestor of the HLAinteger64BE and HLAinteger64LE
concrete classes.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAinteger64
   extends HLAbasicType
{
   /** The 64-bit integer value: a Java long. */
   protected long _value;

   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 8;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 8;

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Long.toString(getValue());
   }
   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      if (! this.getClass().equals(otherObject.getClass())) return
false;
//    if (this.isBigEndian() !=
((HLAinteger64)otherObject).isBigEndian()) return false;
      return (getValue() == ((HLAinteger64)otherObject).getValue());
   }

   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return new Long(getValue()).hashCode();
   }

   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      return ( isBigEndian() ? byteWrapper.putLong(getValue()) :
byteWrapper.putLongLE(getValue()) );
   }

   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         if (isBigEndian())
         { setValue(byteWrapper.getLong()); }
         else
         { setValue(byteWrapper.getLongLE()); }
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   //Class-specific extensions

   /**
    * Returns the long value of <code>this</code>.
    * @return the long value of <code>this</code>
    * @see #setValue
    */
   public long
   getValue()
   {
      return _value;
   }

   /**
    * Sets the long value of <code>this</code>.
    * @param value the long new value for <code>this</code>
    * @see #getValue
    */
   public void
   setValue(long value)
   {
      _value = value;
   }

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public abstract boolean
   isBigEndian();
}
//end HLAinteger64
```

```
// File: HLAinteger64BE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 64-bit big-endian integer basic data type.
 * It uses the <code>long</code> Java type to store the value (not the
byte sequence).
 * <p>
 * <code>HLAinteger64BE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAinteger64BEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteger64BE
   extends HLAinteger64
{
   /**
    * Constructs a <code>HLAinteger64BE</code> of default value
(zero).
    */
   public
   HLAinteger64BE()
   {
      //super() not called because super-class is abstract
      //Default _value is zero
   }

   /**
    * Constructs a <code>HLAinteger64BE</code> of the specified value.
    * @param value a long specifying <code>this</code>' value
    */
   public
   HLAinteger64BE(long value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAinteger64BE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger64BE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger64BE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAinteger64BE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger64BE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAinteger64BE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger64BE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAinteger64BE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAinteger64BE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public HLAinteger64BE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return true;
   }
}
//end HLAinteger64BE
```

```
// File: HLAinteger64LE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 64-bit little-endian integer basic data type.
 * It uses the <code>long</code> Java type to store the value (not the
byte sequence).
 * <p>
 * <code>HLAinteger64LE</code>s are normally never obtained directly,
as the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAinteger64LEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteger64LE
   extends HLAinteger64
{
   /**
    * Constructs a <code>HLAinteger64LE</code> of default value
(zero).
    */
   public
   HLAinteger64LE()
   {
      //super() not called because super-class is abstract
      //Default _value is zero
   }

   /**
    * Constructs a <code>HLAinteger64LE</code> of the specified value.
    * @param value a long specifying <code>this</code>' value
    */
   public
   HLAinteger64LE(long value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAinteger64LE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger64LE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger64LE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAinteger64LE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAinteger64LE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAinteger64LE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteger64LE(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAinteger64LE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAinteger64LE</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteger64LE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return false;
   }
}
//end HLAinteger64LE
```

```
// File: HLAfloat32.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Abstract type-safe 32-bit IEEE 754-1985 floating point basic data
type.
 * It uses the <code>float</code> Java type to store the value (not
the byte sequence)
 * and is the ancestor of the HLAfloat32BE and HLAfloat32LE concrete
classes.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAfloat32
   extends HLAbasicType
{
   /** The stored 32-bit IEEE 754-1985 floating point value: a Java
float. */
   protected float _value;

   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 4;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 4;

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Float.toString(getValue());
   }
   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      if (! this.getClass().equals(otherObject.getClass())) return
false;
//    if (this.isBigEndian() !=
((HLAfloat32)otherObject).isBigEndian()) return false;
      return (getValue() == ((HLAfloat32)otherObject).getValue());
   }

   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return new Float(getValue()).hashCode();
   }

   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      return ( isBigEndian() ?
byteWrapper.putInt(Float.floatToRawIntBits(getValue())) :
byteWrapper.putIntLE(Float.floatToRawIntBits(getValue())) );
   }

   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         if (isBigEndian())
         { setValue(Float.intBitsToFloat(byteWrapper.getInt())); }
         else
         { setValue(Float.intBitsToFloat(byteWrapper.getIntLE())); }
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   //Class-specific extensions

   /**
    * Returns the float value of <code>this</code>.
    * @return the float value of <code>this</code>
    * @see #setValue
    */
   public float
   getValue()
   {
      return _value;
   }

   /**
    * Sets the float value of <code>this</code>.
    * @param value the float new value for <code>this</code>
    * @see #getValue
    */
   public void
   setValue(float value)
   {
      _value = value;
   }

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public abstract boolean
   isBigEndian();
}
//end HLAfloat32
```

```
// File: HLAfloat32BE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit big-endian IEEE 754-1985 floating point basic data
type.
 * It uses the <code>float</code> Java type to store the value (not
the byte sequence).
 * <p>
 * <code>HLAfloat32BE</code>s are normally never obtained directly, as
the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAfloat32BEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAfloat32BE
   extends HLAfloat32
{
   /**
    * Constructs a <code>HLAfloat32BE</code> of default value (NaN).
    */
   public
   HLAfloat32BE()
   {
      //super() not called because super-class is abstract
      setValue(Float.NaN); //Java's default is "positive zero"
   }

   /**
    * Constructs a <code>HLAfloat32BE</code> of the specified value.
    * @param value a float specifying <code>this</code>' value
    */
   public
   HLAfloat32BE(float value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAfloat32BE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat32BE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat32BE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAfloat32BE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat32BE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAfloat32BE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat32BE(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAfloat32BE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAfloat32BE</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAfloat32BE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return true;
   }
}
//end HLAfloat32BE
```

```
// File: HLAfloat32LE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit little-endian IEEE 754-1985 floating point basic
data type.
 * It uses the <code>float</code> Java type to store the value (not
the byte sequence).
 * <p>
 * <code>HLAfloat32LE</code>s are normally never obtained directly, as
the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAfloat32LEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAfloat32LE
   extends HLAfloat32
{
   /**
    * Constructs a <code>HLAfloat32LE</code> of default value (NaN).
    */
   public
   HLAfloat32LE()
   {
      //super() not called because super-class is abstract
      setValue(Float.NaN); //Java's default is "positive zero"
   }

   /**
    * Constructs a <code>HLAfloat32LE</code> of the specified value.
    * @param value a float specifying <code>this</code>' value
    */
   public
   HLAfloat32LE(float value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAfloat32LE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat32LE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat32LE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAfloat32LE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat32LE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAfloat32LE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat32LE(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAfloat32LE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAfloat32LE</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAfloat32LE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return false;
   }
}
//end HLAfloat32LE
```

```
// File: HLAfloat64.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Abstract type-safe 64-bit IEEE 754-1985 floating point basic data
type.
 * It uses the <code>double</code> Java type to store the value (not
the byte sequence)
 * and is the ancestor of the HLAfloat64BE and HLAfloat64LE concrete
classes.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAfloat64
   extends HLAbasicType
{
   /** The 64-bit IEEE 754-1985 floating point value: a Java double.
*/
   protected double _value;

   /** Length (in bytes) of the <code>byte[]</code> representation of
this class. */
   public final static int
   encodedLength = 8;

   /** Octet boundary of this class. */
   public final static int
   octetBoundary = 8;

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Double.toString(getValue());
   }
   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      if (! this.getClass().equals(otherObject.getClass())) return
false;
//    if (this.isBigEndian() !=
((HLAfloat64)otherObject).isBigEndian()) return false;
      return (getValue() == ((HLAfloat64)otherObject).getValue());
   }

   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return new Double(getValue()).hashCode();
   }

   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return encodedLength;
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      return ( isBigEndian() ?
byteWrapper.putLong(Double.doubleToRawLongBits(getValue())) :
byteWrapper.putLongLE(Double.doubleToRawLongBits(getValue())) );
   }
   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         if (isBigEndian())
         { setValue(Double.longBitsToDouble(byteWrapper.getLong())); }
         else
         { setValue(Double.longBitsToDouble(byteWrapper.getLongLE()));
}
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   //Class-specific extensions

   /**
    * Returns the double value of <code>this</code>.
    * @return the double value of <code>this</code>
    * @see #setValue
    */
   public double
   getValue()
   {
      return _value;
   }

   /**
    * Sets the double value of <code>this</code>.
    * @param value the double new value for <code>this</code>
    * @see #getValue
    */
   public void
   setValue(double value)
   {
      _value = value;
   }
   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public abstract boolean
   isBigEndian();
}
//end HLAfloat64
```

```
// File: HLAfloat64BE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 64-bit big-endian IEEE 754-1985 floating point basic data
type.
 * It uses the <code>double</code> Java type to store the value (not
the byte sequence).
 * <p>
 * <code>HLAfloat64BE</code>s are normally never obtained directly, as
the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAfloat64BEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAfloat64BE
   extends HLAfloat64
{
   /**
    * Constructs a <code>HLAfloat64BE</code> of default value (NaN).
    */
   public
   HLAfloat64BE()
   {
      //super() not called because super-class is abstract
      setValue(Double.NaN); //Java's default value is "positive zero"
   }

   /**
    * Constructs a <code>HLAfloat64BE</code> of the specified value.
    * @param value a double specifying <code>this</code>' value
    */
   public
   HLAfloat64BE(double value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAfloat64BE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat64BE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat64BE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAfloat64BE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat64BE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAfloat64BE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat64BE(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAfloat64BE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAfloat64BE</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAfloat64BE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return true;
   }
}
//end HLAfloat64BE
```

```
// File: HLAfloat64LE.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 64-bit little-endian IEEE 754-1985 floating point basic
data type.
 * It uses the <code>double</code> Java type to store the value (not
the byte sequence).
 * <p>
 * <code>HLAfloat64LE</code>s are normally never obtained directly, as
the RTI uses simple data types instead.
 * <p>
 * They could also be obtained by using an eventual
<code>HLAfloat64LEfactory</code>'s decode method on a
<code>byte[]</code>
 * received as part of an attribute update or interaction. However, no
such factory is currently supplied by the RTIambassador.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAfloat64LE
   extends HLAfloat64
{
   /**
    * Constructs a <code>HLAfloat64LE</code> of default value (NaN).
    */
   public
   HLAfloat64LE()
   {
      //super() not called because super-class is abstract
      setValue(Double.NaN); //Java's default value is "positive zero"
   }

   /**
    * Constructs a <code>HLAfloat64LE</code> of the specified value.
    * @param value a double specifying <code>this</code>' value
    */
   public
   HLAfloat64LE(double value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAfloat64LE</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat64LE</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat64LE(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAfloat64LE</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfloat64LE</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAfloat64LE</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfloat64LE(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAfloat64LE</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAfloat64LE</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAfloat64LE(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   //Class-specific extensions

   /**
    * Returns true if the class is big-endian.
    * @return a boolean which is true if the class is big-endian
    */
   public boolean
   isBigEndian()
   {
      return false;
   }
}
//end HLAfloat64LE
```

The next three classes implement the HLA simple datatypes. In most cases the underlying basic datatype is simply extended and the constructors redeclared, but the `HLAASCIIchar` and `HLAunicodeChar` classes need a little extra because of the way Java treats characters.

```
// File: HLAbyte.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 8-bit byte simple data type.
 * It uses the <code>HLAoctet</code> basic data type.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAbyte
   extends HLAoctet
{
   /**
    * Constructs a <code>HLAbyte</code> of default value (zero).
    */
   public
   HLAbyte()
   {
      super();
   }

   /**
    * Constructs a <code>HLAbyte</code> of the specified value.
    * @param value a byte specifying <code>this</code>' value
    */
   public
   HLAbyte(byte value)
   {
      super(value);
   }

   /**
    * Creates a <code>HLAbyte</code> from the network representation
in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAbyte</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAbyte(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }
   /**
    * Creates a <code>HLAbyte</code> from the network representation
in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAbyte</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAbyte</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAbyte(byte[] buffer,
           int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }

   /**
    * Creates a <code>HLAbyte</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAbyte</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAbyte(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }
}
//end HLAbyte
```

```
// File: HLAASCIIchar.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 8-bit ASCII character simple data type.
 * It uses the <code>HLAoctet</code> basic data type.
 * The first 128 characters of the Unicode character encoding are the
ASCII characters (cf. ANSI/INCITS 4-1986(R1997)).
 * The Java <code>char</code> primitive type is a 16-bit unsigned
integer representing Unicode characters.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAASCIIchar
   extends HLAoctet
{
   /**
    * Constructs a <code>HLAASCIIchar</code> of default value (Unicode
Null).
    */
   public
   HLAASCIIchar()
   {
      super();
   }

   /**
    * Constructs a <code>HLAASCIIchar</code> of the specified value.
    * An exception occurs if the specified char is not ASCII.
    * @param value a char specifying <code>this</code>' value
    * @throws IllegalArgumentException if the value isn't ASCII
(numeric range 0..127)
    */
   public
   HLAASCIIchar(char value)
      throws IllegalArgumentException
   {
      super(verify(value));
   }
   /**
    * Constructs a <code>HLAASCIIchar</code> from the specified
String.
    * @param s a String whose charAt(0) specifies <code>this</code>'
value
    * @throws IllegalArgumentException if the String is empty or its
first character isn't ASCII
    */
   public
   HLAASCIIchar(String s)
      throws IllegalArgumentException
   {
      super(verify(s)); //This includes the zero-length string
exception
   }

   /**
    * Constructs a <code>HLAASCIIchar</code> from the specified
Object.
    * @param o an Object whose toString().charAt(0) specifies
<code>this</code>' value
    * @throws IllegalArgumentException if Object.toString() is empty
or its first character isn't ASCII
    */
   public
   HLAASCIIchar(Object o)
      throws IllegalArgumentException
   {
      this(o.toString());
   }

   /**
    * Creates a <code>HLAASCIIchar</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAASCIIchar</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAASCIIchar(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAASCIIchar</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAASCIIchar</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAASCIIchar</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAASCIIchar(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAASCIIchar</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAASCIIchar</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAASCIIchar(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   /**
    * Verifies if the char value is ASCII and returns its byte value.
    * @param value the char to verify
    * @return the byte representation of the ASCII character
    * @throws IllegalArgumentException if value is not in the 00..7F
range
    */
   protected final static byte
   verify(char value)
      throws IllegalArgumentException
   {
      if (value > 0x0FFF)
      {
        throw new IllegalArgumentException("0x"   +
Integer.toHexString((int)value));
      }
      else if (value > 0x00FF)
      {
        throw new IllegalArgumentException("0x0"  +
Integer.toHexString((int)value));
      }
      else if (value > 0x007F)
      {
        throw new IllegalArgumentException("0x00" +
Integer.toHexString((int)value));
      }
      else
      {
         //Verification succeeded
         return (byte)value;
      }
   }

   /**
    * Verifies if the specified String is ASCII and returns the byte
value of its first character.
    * @param s the String to verify
    * @return the byte representation of the String's first character
(ASCII)
    * @throws IllegalArgumentException if value is not in the 00..7F
range
    */
   protected final static byte
   verify(String s)
      throws IllegalArgumentException
   {
      if (s.length() <= 0) throw new IllegalArgumentException();
      return verify(s.charAt(0));
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Character.toString(getChar());
   }

   //Class-specific extensions

   /**
    * Returns the char value of <code>this</code>.
    * @return the char value of <code>this</code>
    */
   public char
   getChar()
   {
      return (char)getValue();
   }

   /**
    * Returns <code>this</code> value as a Character.
    * @return the Character representation of <code>this</code> value
    */
   protected Character
   getCharacter()
   {
      return new Character(getChar());
   }

   //Override to force verify
   /**
    * Sets the byte value of <code>this</code>.
    * @param value the byte new value for <code>this</code>
    * @throws IllegalArgumentException if the value isn't ASCII
    */
   public void
   setValue(byte value)
   {
      super.setValue(verify((char)value));
   }
   //Overload
   /**
    * Sets the char value of <code>this</code>.
    * @param value the char new value for <code>this</code>
    * @throws IllegalArgumentException if the value isn't ASCII
    */
   public void
   setValue(char value)
   {
      //We could also write "setValue(verify(value));" but this would
end up calling verify twice
      super.setValue(verify(value));
   }
}
//end HLAASCIIchar
```

```
// File: HLAunicodeChar.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 16-bit Unicode character simple data type.
 * It uses the <code>HLAoctetPairBE</code> basic data type.
 * The Java <code>char</code> primitive type is a 16-bit unsigned
integer representing Unicode characters.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAunicodeChar
   extends HLAoctetPairBE
{
   /**
    * Constructs a <code>HLAunicodeChar</code> of default value
(Unicode Null).
    */
   public
   HLAunicodeChar()
   {
      super();
   }

   /**
    * Constructs a <code>HLAunicodeChar</code> of the specified value.
    * @param value a char specifying <code>this</code>' value
    */
   public
   HLAunicodeChar(char value)
   {
      super(value);
   }

   /**
    * Constructs a <code>HLAunicodeChar</code> from the specified
String.
    * @param s a String whose charAt(0) specifies <code>this</code>
    * @throws IllegalArgumentException if s is empty.
    */
   public
   HLAunicodeChar(String s)
      throws IllegalArgumentException
   {
      this();
      if (s.length() <= 0) throw new IllegalArgumentException();
      setValue(s.charAt(0));
   }
   /**
    * Constructs a <code>HLAunicodeChar</code> from the specified
Object.
    * @param o an Object whose toString().charAt(0) specifies
<code>this</code>' value
    */
   public
   HLAunicodeChar(Object o)
   {
      this(o.toString());
   }

   /**
    * Creates a <code>HLAunicodeChar</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAunicodeChar</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAunicodeChar(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAunicodeChar</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAunicodeChar</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAunicodeChar</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAunicodeChar(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAunicodeChar</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAunicodeChar</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAunicodeChar(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Character.toString(getValue());
   }

   //Class-specific extensions

   // getValue already returns a char.
   /**
    * Returns <code>this</code> value as a Character.
    * @return the Character representation of <code>this</code> value
    */
   protected Character
   getCharacter()
   {
      return new Character(getValue());
   }

   //Overload
   /**
    * Sets the short value of <code>this</code>.
    * @param value the short new value for <code>this</code>
    */
   public void
   setValue(short value)
   {
      setValue((char)value);
   }
}
//end HLAunicodeChar
```

The next four classes implement the HLA MOM simple datatypes.

```
// File: HLAcount.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit big-endian integer basic data type used by the
Management Object Model (MOM).
 * It is an HLAinteger32BE.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAcount
   extends HLAinteger32BE
{
   /**
    * Constructs an <code>HLAcount</code> of default value (zero).
    */
   public
   HLAcount()
   {
      super(); //Default _value is zero
   }

   /**
    * Constructs a <code>HLAcount</code> of the specified value.
    * @param value an int specifying <code>this</code>' value
    */
   public
   HLAcount(int value)
   {
      this();
      setValue(value);
   }

   /**
    * Creates a <code>HLAcount</code> from the network representation
in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAcount</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAcount(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAcount</code> from the network representation
in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAcount</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAcount</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAcount(byte[] buffer,
            int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAcount</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAcount</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAcount(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
}
//end HLAcount
```

```
// File: HLAfederateHandle.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit big-endian integer basic data type used by the
Management Object Model (MOM).
 * It is the type of the argument to the normalizeFederateHandle
service, that is to say, FederateHandle.
 * Stored as an HLAinteger32BE, it is however a pointer to an RTI
defined programming language object, NOT a true HLAInteger32BE.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAfederateHandle
   extends HLAinteger32BE
{
   /**
    * Constructs an <code>HLAfederateHandle</code> of default value
(zero).
    */
   public
   HLAfederateHandle()
   {
      super(); //Default _value is zero
   }

   /**
    * Constructs a <code>HLAfederateHandle</code> of the specified
value.
    * @param value an int specifying <code>this</code>' value
    */
   public
   HLAfederateHandle(int value)
   {
      this();
      setValue(value);
   }
   /**
    * Creates a <code>HLAfederateHandle</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfederateHandle</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfederateHandle(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAfederateHandle</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfederateHandle</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAfederateHandle</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfederateHandle(byte[] buffer,
                     int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAfederateHandle</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAfederateHandle</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAfederateHandle(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
}
//end HLAfederateHandle
```

```
// File: HLAmsec.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit big-endian integer basic data type used by the
Management Object Model (MOM).
 * It is an HLAinteger32BE.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAmsec
   extends HLAinteger32BE
{
   /**
    * Constructs an <code>HLAmsec</code> of default value (zero).
    */
   public
   HLAmsec()
   {
      super(); //Default _value is zero
   }

   /**
    * Constructs a <code>HLAmsec</code> of the specified value.
    * @param value an int specifying <code>this</code>' value
    */
   public
   HLAmsec(int value)
   {
      this();
      setValue(value);
   }

   /**
    * Creates a <code>HLAmsec</code> from the network representation
in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAmsec</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAmsec(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAmsec</code> from the network representation
in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAmsec</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAmsec</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAmsec(byte[] buffer,
           int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAmsec</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAmsec</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAmsec(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
}
//end HLAmsec
```

```
// File: HLAseconds.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe 32-bit big-endian integer basic data type used by the
Management Object Model (MOM).
 * It is an HLAinteger32BE.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAseconds
   extends HLAinteger32BE
{
   /**
    * Constructs an <code>HLAseconds</code> of default value (zero).
    */
   public
   HLAseconds()
   {
      super(); //Default _value is zero
   }

   /**
    * Constructs a <code>HLAseconds</code> of the specified value.
    * @param value an int specifying <code>this</code>' value
    */
   public
   HLAseconds(int value)
   {
      this();
      setValue(value);
   }

   /**
    * Creates a <code>HLAseconds</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAseconds</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAseconds(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAseconds</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAseconds</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAseconds</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAseconds(byte[] buffer,
              int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAseconds</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAseconds</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAseconds(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
}
//end HLAseconds
```

In constructing enumerated datatypes, it was assumed the pattern established by such classes as `ResignAction` would be followed.

```
// File: HLAenumerateddatatype.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import java.util.Iterator;

/**
 * Interface implemented by the HLA enumerated data types.
 * <p>
 * An enumerated data type extends a basic data type (like a simple
data type does) and
 * specifies an immutable finite set of prototype values (not
necessarily contiguous nor ordered).
 * <p>
 * Design guidelines:
 * <ul>
 * <li>A private constructor should be used to generate the static
values (the enumerators).</li>
 * <li>The java.lang.Object methods <code>toString()</code>,
<code>equals()</code> and <code>hashCode()</code> may or may not need
to be overridden.</li>
 * <li>Although the inherited <code>getValue()</code> does not need to
be overridden, this may be useful if only to change the Javadoc.</li>
 * <li>The inherited <code>setValue</code>, on the other hand, will
definitely need to be overridden so that it throws an
 * exception when a value other than an acceptable one is passed in,
or an <code>UnsupportedOperationException</code>
 * when applied to one of the static values.</li>
 * <li>Specialised <code>get/set</code> methods can be supplied if
needed.</li>
 * <li>A complete set of prototype immutable (public static final)
instances must be generated by the class initializer.</li>
 * <li>There must be a <code>public static Iterator iterator()</code>
method that returns an Iterator over the enumeration's elements
(prototype immutable instances).
 * This Iterator must throw an
<code>UnsupportedOperationException</code> in response to its
<code>remove()</code> method.</li>
 * <li>There must also be a <code>public static Iterator
nameIterator()</code> method which returns an Iterator over the names
of the enumeration's elements, in the same sequence as
<code>iterator()</code>.</li>
 * </ul>
 * In order to facilitate the implementation, the class
HLAenumeratedIterator is supplied;
 * it defines constructors which should fulfill the contracts without
modification.
 * See the comments below and the HLAboolean class for examples.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
```

```
public interface
HLAenumerateddatatype
   extends HLAdatatype
{
   /**
    * Returns an <code>Iterator</code> over the enumeration's
elements.
    * Note that the <code>Iterator</code> returned by this method
should throw an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException;
// {
//    //You can use the self-defining Iterator:
//    return new HLAenumeratedIterator(HLAboolean.class, false);
//    //Or you can specify the enumerators manually:
//    return new HLAenumeratedIterator(new Object[] {
HLAboolean.HLAfalse, HLAboolean.HLAtrue }, false);
// }

   /**
    * Returns an <code>Iterator</code> over the enumeration's element
names.
    * Note that the <code>Iterator</code> returned by this method
throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This <code>nameIterator</code> is guaranteed to match the
sequence of the other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException;
// {
//    //You can use the self-defining Iterator:
//    return new HLAenumeratedIterator(HLAboolean.class, true);
//    //Or you can specify the enumerators manually:
//    return new HLAenumeratedIterator(new Object[] {
HLAboolean.HLAfalse, HLAboolean.HLAtrue }, true);
// }
```

```
   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   Class
   getElementClass();
// {
//    return this.getClass().getSuperclass();
// }

   /**
    * Returns true if the instance is immutable.
    * This is useful to distinguish between the class-supplied
prototype instances and
    * the user-created ones (it is not possible to segregate them
completely, since a user-defined
    * reference may end up pointing to a class-supplied immutable
instance).
    * @return a boolean which is true if the instance is immutable
    */
   boolean
   isImmutable();
}
//end HLAenumerateddatatype
```

```
// File: HLAenumeratedIterator.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import java.util.Iterator;
import java.util.NoSuchElementException;
import java.util.ArrayList;
import java.lang.reflect.Field;
import java.lang.reflect.Modifier;

/**
 * Iterator implementation for HLA enumerated types.
 * Since the backing object (an HLA enumerated data type class) is
supposed to be immutable,
 * the Iterator is considerably simplified.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAenumeratedIterator
   implements Iterator
{
   /**
    * The enumerators over which to iterate.
    */
   private Object
   enumerators[];

   /**
    * Index of enumerator to be returned by subsequent call to next().
    */
   private int
   cursor;

   /**
    * Constructs the <code>Iterator</code> from a <code>Class</code>
reference.
    * If the <code>boolean asStrings</code> is false, the
<code>Iterator</code> will enumerate the <code>Object</code>s;
    * otherwise it will enumerate the field names as
<code>String</code>s.
    * <p>
    * Examples: <code>Iterator itr = new
HLAenumeratedIterator(HLAboolean.class, false);</code>
    * <code>Iterator nameItr = new
HLAenumeratedIterator(HLAboolean.class, true);</code>
    * @param theClass the Class whose public static final instances
are to be enumerated
    * @param asStrings a boolean which is false if the enumeration
should supply Objects, true if it should supply the field names (as
Strings) instead
    * @throws ClassCastException if theInstance doesn't implement the
HLAenumerateddatatype interface (or an IllegalAccessException occurred
internally)
    */
   public
   HLAenumeratedIterator(Class theClass, boolean asStrings)
      throws ClassCastException
   {
      if (!HLAenumerateddatatype.class.isAssignableFrom(theClass))
throw new ClassCastException(theClass.toString());
      int mods;
      cursor = 0;
      ArrayList al = new ArrayList();
      //Obtain the class' fields
      Field[] theFields = theClass.getFields();
      for (int i = 0; i < theFields.length; i++)
      {
         //We're looking for fields which are instances of the class
itself
         if (theFields[i].getType().equals(theClass))
         {
            //Must also be Final, Public and Static
            mods = theFields[i].getModifiers();
            if (Modifier.isFinal(mods) && Modifier.isPublic(mods) &&
Modifier.isStatic(mods))
            {
               if (asStrings)
               {
                  al.add(theFields[i].getName());
               }
               else
               {
                  //To simplify the constructor, the
IllegalAccessException that this may throw is wrapped in a
ClassCastException
                  try
                  {
                     al.add(theFields[i].get(null));
                  } catch (IllegalAccessException e)
                  {
                     ClassCastException cce = new
ClassCastException(e.getMessage());
                     throw (ClassCastException)cce.initCause(e);
                  }
               }
            }
         }
      }
      al.trimToSize();
      enumerators = al.toArray();
   }
   /**
    * Constructs the enumeration using the specified enumerators.
    * This can be used to change the enumeration order, repeat or omit
enumerators.
    * If the <code>boolean asStrings</code> is false, the
<code>Iterator</code> will enumerate the <code>Object</code>s;
    * otherwise it will enumerate the prototype field names as
<code>String</code>s.
    * <p>
    * A prototype field is a field of a class or instance whose class
is the same as the class or instance's class.
    * For example, the prototype fields of the <code>HLAboolean</code>
class are <code>HLAfalse</code> and <code>HLAtrue</code>.
    * <p>
    * The names of <code>theEnumerators</code> that are not prototype
fields of their classes will appear <code>null</code>.
    * Note that the constructor expects <code>theEnumerators</code> to
all be <code>Object</code>s of the same <code>Class</code>,
    * which must implement the HLAenumerateddatatype interface.
    * However, it does not demand that the fields be <code>public
static final</code>.
    * <p>
    * Examples: <code>Iterator itr = new HLAenumeratedIterator(new
Object[] { HLAboolean.HLAfalse, HLAboolean.HLAtrue }, false );</code>
    * <code>Iterator nameItr = new HLAenumeratedIterator(new Object[]
{ HLAboolean.HLAfalse, HLAboolean.HLAtrue }, true);</code>
    * @param theEnumerators an Object[] specifying the enumerators and
their order
    * @param asStrings a boolean which is false if the enumeration
should supply theEnumerators, true if it should supply their field
names (as Strings) instead
    * @throws ClassCastException if theInstance doesn't implement the
HLAenumerateddatatype interface (or an IllegalAccessException occurred
internally)
    */
   public
   HLAenumeratedIterator(Object[] theEnumerators, boolean asStrings)
      throws ClassCastException
   {
      //Validate theEnumerators
      for (int i = 0; i < theEnumerators.length; i++)
      {
         if
(!HLAenumerateddatatype.class.isAssignableFrom(theEnumerators[i].getCl
ass())) throw new
ClassCastException(theEnumerators[i].getClass().toString());
         if (i > 0)
         {
            //Make sure they're both the same class (if each one is
castable to the other, then they must be of precisely the same class)
            if (! (
theEnumerators[i].getClass().isInstance(theEnumerators[i-1]) &&
theEnumerators[i-1].getClass().isInstance(theEnumerators[i]) ) ) throw
new ClassCastException(theEnumerators[i].getClass().toString());
         }
      }

      cursor = 0;
      if (!asStrings)
      {
         enumerators = theEnumerators;
         return;
      }
      //Set up a String enumeration
      enumerators = new Object[theEnumerators.length];
      for (int i = 0; i < enumerators.length; i++)
      {
         //Obtain the class' fields
         java.lang.reflect.Field[] theFields =
theEnumerators[i].getClass().getFields();
         for (int j = 0; j < theFields.length; j++)
         {
            //To simplify the constructor, the IllegalAccessException
that this may throw is wrapped in a ClassCastException
            try
            {
               if
(theFields[j].getType().equals(theEnumerators[i].getClass()) &&
(theFields[j].get(null) == theEnumerators[i]))
               {
//                enumerators[i] =
theEnumerators[i].getClass().getName() + "." + theFields[i].getName();
                  enumerators[i] =
theFields[j].getName();
                  break;
               }
            } catch (IllegalAccessException e) {
               ClassCastException cce = new
ClassCastException(e.getMessage());
               throw (ClassCastException)cce.initCause(e);
            }
         }
      }
   }

   //Iterator implementation

   /**
    * Returns <code>true</code> if the iteration has more elements.
    * In other words, returns <code>true</code> if <code>next()</code>
would return an element rather than throwing an exception.
    * @return a boolean which is <code>true</code> if the iterator has
more elements
    */
   public boolean
   hasNext()
   {
      return cursor < enumerators.length;
   }
   /**
    * Returns the next element in the iteration.
    * @return the next element in the iteration
    * @throws NoSuchElementException if the iteration has no more
elements
    */
   public Object
   next()
   {
      if (hasNext()) return enumerators[cursor++];
      throw new NoSuchElementException();
   }

   /**
    * Removes from the underlying collection the last element returned
by the iterator (optional operation).
    * This method can be called only once per call to
<code>next()</code>.
    * The behaviour of an <code>Iterator</code> is unspecified if the
underlying collection is modified
    * while the iteration is in progress in any way other than by
calling this method.
    * @throws UnsupportedOperationException if this operation is not
supported by this Iterator
    * @throws IllegalStateException if <code>next()</code> has not yet
been called, or <code>remove()</code> has already been called since
the last call to <code>next()</code>.
    */
   public void
   remove()
   {
      throw new UnsupportedOperationException();
   }
}
//end HLAenumeratedIterator
```

There is only one OMT-specified enumerated datatype: HLAboolean. The MOM, on the other hand, adds eight more.

```
// File: HLAboolean.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe boolean enumerated data type.
 * Uses the <code>HLAinteger32BE</code> basic data type with 0 for
HLAfalse and 1 for HLAtrue.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * It can be used as a template for other HLA enumerated data types.
 * <p>
 * Design guidelines:
 * <ul>
 * <li>A private constructor should be used to generate the static
values (the enumerators).</li>
 * <li>The java.lang.Object methods toString(), equals() and
hashCode() may or may not need to be overridden.</li>
 * <li>Although the inherited getValue() does not need to be
overridden, this may be useful if only to change the Javadoc.</li>
 * <li>The inherited setValue, on the other hand, will definitely need
to be overridden so that it throws an
 * exception when a value other than an acceptable one is passed in,
or an UnsupportedOperationException
 * when applied to one of the static values.</li>
 * <li>Specialised get/set methods can be supplied if needed.</li>
 * <li>The enumerators should appear as a series of static public
final instances.</li>
 * </ul>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.01 //Deleted commented-out inherited setValue
 */
public class
HLAboolean
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(0);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());
   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAboolean</code> of default (false) value.
    */
   public
   HLAboolean()
   {
      super();
      _immutable = false;
   }

   /**
    * Constructs a <code>HLAboolean</code> of the specified boolean
value.
    * @param value a boolean specifying <code>this</code>' value
    */
   public
   HLAboolean(boolean value)
   {
      this();
      setBoolean(value);
   }

   /**
    * Constructs a <code>HLAboolean</code> from another one.
    * @param otherHLAboolean must be a defined static value or another
instance
    */
   public
   HLAboolean(HLAboolean otherHLAboolean)
   {
      this(otherHLAboolean.getBoolean());
   }

   /**
    * Creates a <code>HLAboolean</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAboolean</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAboolean(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAboolean</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAboolean</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAboolean</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAboolean(byte[] buffer,
              int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAboolean</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAboolean</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAboolean(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAboolean(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() + 1);
   }
   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAboolean.class, false);
   }

   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAboolean.class, true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }
   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * This implementation should work with all HLAenumerateddatatypes;
HLAboolean is peculiar.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
// public String
// toString()
// {
//    Iterator i = iterator();
//    Iterator n = nameIterator();
//    String s;
//    while (i.hasNext())
//    {
//       s = (String)n.next();
//       if (i.next().equals(this)) return s;
//    }
//    //Cannot happen, but the compiler doesn't know this
//    return "";
// }

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return Boolean.toString(getBoolean());
   }
   /**
    * Returns a hash code for <code>this</code>; two objects for which
<code>equals()</code> is <code>true</code> should yield the same hash
code.
    * @return an <code>int</code> hash code
    * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
    * @see java.util.Hashtable Hashtable
    */
   public int
   hashCode()
   {
      return Boolean.valueOf(getBoolean()).hashCode();
   }

   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * A value of zero means false, any other value means true (but
will be stored as 1).
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException
   {
      setBoolean(value != 0);
   }

   /**
    * Returns the boolean value of <code>this</code>.
    * @return the boolean value of <code>this</code>
    * @see #setBoolean
    */
   public boolean
   getBoolean()
   {
      return (getValue() != 0);
   }
   /**
    * Sets the boolean value of <code>this</code>.
    * @param value the boolean new value for <code>this</code>
    * @throws UnsupportedOperationException if applied to an
enumerator instance
    * @see #getBoolean
    */
   public void
   setBoolean(boolean value)
      throws UnsupportedOperationException
   {
      if (_immutable) throw new UnsupportedOperationException();
//"Cannot setBoolean of immutable instance"
      if (value)
      {
         //Must call super.setValue explicitly because setValue calls
setBoolean!
         super.setValue(1); //HLAtrue
      }
      else
      {
         super.setValue(0); //HLAfalse
      };
   }

   //The prototype immutable instances (the enumerators)

   /**
    * False.
    */
   static public final HLAboolean
   HLAfalse = new HLAboolean(_nextToAssign);

   /**
    * True.
    */
   static public final HLAboolean
   HLAtrue = new HLAboolean(_nextToAssign);
}
//end HLAboolean
```

```
// File: HLAfederateState.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe federateState enumerated data type, used by the
Management Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 1 for
ActiveFederate,
 * 3 for FederateSaveInProgress and 5 for FederateRestoreInProgress.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAfederateState
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(1);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(2);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAfederateState</code> of default
(ActiveFederate) value.
    */
   public
   HLAfederateState()
   {
      super(1);
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAfederateState</code> from another one.
    * @param otherHLAfederateState must be a defined static value or
another instance
    */
   public
   HLAfederateState(HLAfederateState otherHLAfederateState)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAfederateState.getValue());
   }

   /**
    * Creates a <code>HLAfederateState</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfederateState</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfederateState(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAfederateState</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfederateState</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAfederateState</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAfederateState(byte[] buffer,
                    int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAfederateState</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAfederateState</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAfederateState(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAfederateState(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAfederateState.class, false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAfederateState.class, true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//         if (((HLAresignAction)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }
   //The prototype immutable instances (the enumerators)

   /**
    * ActiveFederate.
    */
   static public final HLAfederateState
   ActiveFederate = new HLAfederateState(_nextToAssign);

   /**
    * FederateSaveInProgress.
    */
   static public final HLAfederateState
   FederateSaveInProgress = new HLAfederateState(_nextToAssign);

   /**
    * FederateRestoreInProgress.
    */
   static public final HLAfederateState
   FederateRestoreInProgress = new HLAfederateState(_nextToAssign);
}
//end HLAfederateState
```

```
// File: HLAorderType.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe orderType enumerated data type, used by the Management
Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 0 for
Receive
 * and 1 for TimeStamp.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAorderType
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(0);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(1);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAorderType</code> of default
(ActiveFederate) value.
    */
   public
   HLAorderType()
   {
      super();
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAorderType</code> from another one.
    * @param otherHLAorderType must be a defined static value or
another instance
    */
   public
   HLAorderType(HLAorderType otherHLAorderType)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAorderType.getValue());
   }

   /**
    * Creates a <code>HLAorderType</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAorderType</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAorderType(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAorderType</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAorderType</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAorderType</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAorderType(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAorderType</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAorderType</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAorderType(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAorderType(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAorderType.class, false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAorderType.class, true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//       if (((HLAorderType)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }

   //The prototype immutable instances (the enumerators)

   /**
    * Receive.
    */
   static public final HLAorderType
   Receive = new HLAorderType(_nextToAssign);

   /**
    * TimeStamp.
    */
   static public final HLAorderType
   TimeStamp = new HLAorderType(_nextToAssign);
}
//end HLAorderType
```

```
// File: HLAownership.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe ownership enumerated data type, used by the Management
Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 0 for
Unowned
 * and 1 for Owned.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAownership
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(0);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(1);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAownership</code> of default
(ActiveFederate) value.
    */
   public
   HLAownership()
   {
      super();
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAownership</code> from another one.
    * @param otherHLAownership must be a defined static value or
another instance
    */
   public
   HLAownership(HLAownership otherHLAownership)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAownership.getValue());
   }

   /**
    * Creates a <code>HLAownership</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAownership</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAownership(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAownership</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAownership</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAownership</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAownership(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAownership</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAownership</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAownership(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAownership(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAownership.class, false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAownership.class, true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//       if (((HLAresignAction)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }

   //The prototype immutable instances (the enumerators)

   /**
    * Unowned.
    */
   static public final HLAownership
   Unowned = new HLAownership(_nextToAssign);

   /**
    * Owned.
    */
   static public final HLAownership
   Owned = new HLAownership(_nextToAssign);
}
//end HLAownership
```

```
// File: HLAresignAction.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe resignAction enumerated data type, used by the Management
Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 1 for
DivestOwnership
 * through 6 for NoAction.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAresignAction
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(1);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(1);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAresignAction</code> of default
(ActiveFederate) value.
    */
   public
   HLAresignAction()
   {
      super();
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAresignAction</code> from another one.
    * @param otherHLAresignAction must be a defined static value or
another instance
    */
   public
   HLAresignAction(HLAresignAction otherHLAresignAction)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAresignAction.getValue());
   }

   /**
    * Creates a <code>HLAresignAction</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAresignAction</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAresignAction(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAresignAction</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAresignAction</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAresignAction</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAresignAction(byte[] buffer,
                   int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAresignAction</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAresignAction</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAresignAction(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAresignAction(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAresignAction.class, false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAresignAction.class, true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//       if (((HLAresignAction)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }
   //The prototype immutable instances (the enumerators)

   /**
    * DivestOwnership.
    */
   static public final HLAresignAction
   DivestOwnership = new HLAresignAction(_nextToAssign);

   /**
    * DeleteObjectInstances.
    */
   static public final HLAresignAction
   DeleteObjectInstances = new HLAresignAction(_nextToAssign);

   /**
    * CancelPendingAcquisitions.
    */
   static public final HLAresignAction
   CancelPendingAcquisitions = new HLAresignAction(_nextToAssign);

   /**
    * DeleteObjectInstancesThenDivestOwnership.
    */
   static public final HLAresignAction
   DeleteObjectInstancesThenDivestOwnership = new
HLAresignAction(_nextToAssign);

   /**
    *
CancelPendingAcquisitionsThenDeleteObjectInstancesThenDivestOwnership.
    */
   static public final HLAresignAction

CancelPendingAcquisitionsThenDeleteObjectInstancesThenDivestOwnership
= new HLAresignAction(_nextToAssign);

   /**
    * NoAction.
    */
   static public final HLAresignAction
   NoAction = new HLAresignAction(_nextToAssign);
}
//end HLAresignAction
```

```
// File: HLAserviceGroupName.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe serviceGroupName enumerated data type, used by the
Management Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 0 for
FederationManagement
 * through 6 for SupportServices.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAserviceGroupName
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(0);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(1);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAserviceGroupName</code> of default
(FederationManagement) value.
    */
   public
   HLAserviceGroupName()
   {
      super();
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAserviceGroupName</code> from another one.
    * @param otherHLAserviceGroupName must be a defined static value
or another instance
    */
   public
   HLAserviceGroupName(HLAserviceGroupName otherHLAserviceGroupName)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAserviceGroupName.getValue());
   }

   /**
    * Creates a <code>HLAserviceGroupName</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAserviceGroupName</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAserviceGroupName(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAserviceGroupName</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAserviceGroupName</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAserviceGroupName</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAserviceGroupName(byte[] buffer,
                       int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAserviceGroupName</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAserviceGroupName</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAserviceGroupName(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAserviceGroupName(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAserviceGroupName.class,
false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAserviceGroupName.class,
true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//       if (((HLAserviceGroupName)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }
   //The prototype immutable instances (the enumerators)

   /**
    * FederationManagement.
    */
   static public final HLAserviceGroupName
   FederationManagement = new HLAserviceGroupName(_nextToAssign);

   /**
    * DeclarationManagement.
    */
   static public final HLAserviceGroupName
   DeclarationManagement = new HLAserviceGroupName(_nextToAssign);

   /**
    * ObjectManagement.
    */
   static public final HLAserviceGroupName
   ObjectManagement = new HLAserviceGroupName(_nextToAssign);

   /**
    * OwnershipManagement.
    */
   static public final HLAserviceGroupName
   OwnershipManagement = new HLAserviceGroupName(_nextToAssign);

   /**
    * TimeManagement.
    */
   static public final HLAserviceGroupName
   TimeManagement = new HLAserviceGroupName(_nextToAssign);

   /**
    * DataDistributionManagement.
    */
   static public final HLAserviceGroupName
   DataDistributionManagement = new
HLAserviceGroupName(_nextToAssign);

   /**
    * SupportServices.
    */
   static public final HLAserviceGroupName
   SupportServices = new HLAserviceGroupName(_nextToAssign);
}
//end HLAserviceGroupName
```

```
// File: HLAswitch.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe switch enumerated data type, used by the Management
Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 0 for
Disabled
 * and 1 for Enabled.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAswitch
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(0);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(1);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAswitch</code> of default (ActiveFederate)
value.
    */
   public
   HLAswitch()
   {
      super();
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAswitch</code> from another one.
    * @param otherHLAswitch must be a defined static value or another
instance
    */
   public
   HLAswitch(HLAswitch otherHLAswitch)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAswitch.getValue());
   }

   /**
    * Creates a <code>HLAswitch</code> from the network representation
in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAswitch</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAswitch(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAswitch</code> from the network representation
in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAswitch</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAswitch</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAswitch(byte[] buffer,
             int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAswitch</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAswitch</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAswitch(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAswitch(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAswitch.class, false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAswitch.class, true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//       if (((HLAswitch)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }

   //The prototype immutable instances (the enumerators)

   /**
    * Disabled.
    */
   static public final HLAswitch
   Disabled = new HLAswitch(_nextToAssign);

   /**
    * Enabled.
    */
   static public final HLAswitch
   Enabled = new HLAswitch(_nextToAssign);
}
//end HLAswitch
```

```
// File: HLAsyncPointStatus.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe syncPointStatus enumerated data type, used by the
Management Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 0 for
NoActivity
 * through 3 for WaitingForRestOfFederation.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAsyncPointStatus
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(0);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(1);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAsyncPointStatus</code> of default
(ActiveFederate) value.
    */
   public
   HLAsyncPointStatus()
   {
      super();
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAsyncPointStatus</code> from another one.
    * @param otherHLAsyncPointStatus must be a defined static value or
another instance
    */
   public
   HLAsyncPointStatus(HLAsyncPointStatus otherHLAsyncPointStatus)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAsyncPointStatus.getValue());
   }

   /**
    * Creates a <code>HLAsyncPointStatus</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAsyncPointStatus</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointStatus(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAsyncPointStatus</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAsyncPointStatus</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAsyncPointStatus</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointStatus(byte[] buffer,
                      int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAsyncPointStatus</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAsyncPointStatus</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAsyncPointStatus(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAsyncPointStatus(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAsyncPointStatus.class,
false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAsyncPointStatus.class,
true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//       if (((HLAsyncPointStatus)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }
   //The prototype immutable instances (the enumerators)

   /**
    * NoActivity.
    */
   static public final HLAsyncPointStatus
   NoActivity = new HLAsyncPointStatus(_nextToAssign);

   /**
    * AttemptingToRegisterSyncPoint.
    */
   static public final HLAsyncPointStatus
   AttemptingToRegisterSyncPoint = new
HLAsyncPointStatus(_nextToAssign);

   /**
    * MovingToSyncPoint.
    */
   static public final HLAsyncPointStatus
   MovingToSyncPoint = new HLAsyncPointStatus(_nextToAssign);

   /**
    * WaitingForRestOfFederation.
    */
   static public final HLAsyncPointStatus
   WaitingForRestOfFederation = new HLAsyncPointStatus(_nextToAssign);
}
//end HLAsyncPointStatus
```

```
// File: HLAtimeState.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Type-safe timeState enumerated data type, used by the Management
Object Model (MOM).
 * Uses the <code>HLAinteger32BE</code> basic data type with 0 for
TimeGranted
 * and 1 for TimeAdvancing.
 * Note that a cloned immutable instance (a cloned enumerator) will be
immutable also.
 * <p>
 * See {@link HLAboolean} and {@link HLAenumerateddatatype} for the
design guidelines.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAtimeState
   extends HLAinteger32BE
   implements HLAenumerateddatatype
{
   //Initial value for enumeration
   private static final HLAinteger32BE
   _lowestValue = new HLAinteger32BE(0);

   //Enumeration step
   private static final HLAinteger32BE
   _step = new HLAinteger32BE(1);

   //The enumeration begins at the lowest value.
   private static HLAinteger32BE
   _nextToAssign = new HLAinteger32BE(_lowestValue.getValue());

   //Whether this instance is immutable
   private final boolean
   _immutable;

   /**
    * Constructs a <code>HLAtimeState</code> of default
(ActiveFederate) value.
    */
   public
   HLAtimeState()
   {
      super();
      _immutable = false;
   }
   /**
    * Constructs a <code>HLAtimeState</code> from another one.
    * @param otherHLAtimeState must be a defined static value or
another instance
    */
   public
   HLAtimeState(HLAtimeState otherHLAtimeState)
   {
      this();
      //Calling super.setValue directly skips the validation
      super.setValue(otherHLAtimeState.getValue());
   }

   /**
    * Creates a <code>HLAtimeState</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAtimeState</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAtimeState(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAtimeState</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAtimeState</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAtimeState</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAtimeState(byte[] buffer,
                int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAtimeState</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAtimeState</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAtimeState(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Class and subclass constructor; it is used to generate the
static values.
    */
   private
   HLAtimeState(HLAinteger32BE nextToAssign)
   {
      super();
      _immutable = true;
      //Calling super.setValue directly skips the validation
      super.setValue(nextToAssign.getValue());
      nextToAssign.setValue(nextToAssign.getValue() +
_step.getValue());
   }

   //HLAenumerateddatatype implementation

   /**
    * Returns an Iterator over the enumeration's elements.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * @return an Iterator over the elements in this enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   iterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAtimeState.class, false);
   }
   /**
    * Returns an Iterator over the enumeration's element names.
    * Note that the iterator returned by this method throws an
    * <code>UnsupportedOperationException</code> in response to its
    * <code>remove()</code> method.
    * <p>
    * This nameIterator is guaranteed to match the sequence of the
other one.
    * This means you can obtain <code>iterator()</code> and
<code>nameIterator()</code> and then
    * go <code>next()</code> in lock-step to enumerate both the
immutable instances and their names.
    * @return an Iterator over the names of the elements in this
enumeration
    * @throws ClassCastException if the Iterator construction fails
    */
   public Iterator
   nameIterator()
      throws ClassCastException
   {
      return new HLAenumeratedIterator(HLAtimeState.class, true);
   }

   /**
    * Returns the underlying Class of the enumeration's elements (the
elements' representation Class).
    * @return the underlying Class of the enumeration's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteger32BE.class;
//    return this.getClass().getSuperclass(); //non-static only
   }

   /**
    * Returns true if the instance is immutable.
    * @return a boolean which is true if the instance is immutable
    */
   public boolean
   isImmutable()
   {
      return _immutable;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      Iterator i = iterator();
      Iterator n = nameIterator();
      String s;
      while (i.hasNext())
      {
         s = (String)n.next();
         if (i.next().equals(this)) return s;
      }
      //Cannot happen, but the compiler doesn't know this
      return "";
   }
   //Class-specific extensions

   /**
    * The inherited setValue sets <code>this</code> value from an int.
    * @param value the int new value for <code>this</code>
    * @throws UnsupportedOperationException if used on an enumerator
instance
    * @throws IllegalArgumentException if the value isn't one of the
enumerators'
    */
   public void
   setValue(int value)
      throws UnsupportedOperationException,
             IllegalArgumentException
   {
      if (isImmutable()) throw new UnsupportedOperationException();
      Iterator i = iterator();
      Object o;
      while (i.hasNext())
      {
//       if (((HLAresignAction)i.next()).getValue() == value)
super.setValue(value);
         o = i.next();
         try {
            java.lang.reflect.Method gV =
o.getClass().getMethod("getValue", (Class[])null); //throws
NoSuchMethodException, SecurityException
            if (value == ((Integer)(gV.invoke(o,
(Object[])null))).intValue()) //throws  IllegalAccessException,
IllegalArgumentException, InvocationTargetException
            {
               super.setValue(value);
               return;
            }
         } catch (Exception ignored) {}
      }
      throw new IllegalArgumentException();
   }

   //The prototype immutable instances (the enumerators)

   /**
    * ActiveFederate.
    */
   static public final HLAtimeState
   TimeGranted = new HLAtimeState(_nextToAssign);

   /**
    * TimeAdvancing.
    */
   static public final HLAtimeState
   TimeAdvancing = new HLAtimeState(_nextToAssign);
}
//end HLAtimeState
```

The HLAarraydatatype interface combines HLAdatatype with Java's List. The HLAarrayType abstract class extends Java's AbstractList and provides the foundation for the two (abstract) subclasses HLAvariableArrayType and HLAfixedArrayType.

```
// File: HLAarraydatatype.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

/**
 * Interface implemented by the various HLA array data types.
 * <p>
 * In addition to this interface, the HLA array data type classes are
expected to supply:
 * <ul>
 * <li> Constructors (default and specified-value)</li>
 * <li> Constructor (byte[] buffer) throws CouldNotDecode</li>
 * <li> Constructor (byte[] buffer, int offset) throws
CouldNotDecode</li>
 * <li> Constructor (ByteWrapper byteWrapper) throws
CouldNotDecode</li>
 * <li> java.lang.Object methods toString(); equals(Object
otherObject) and hashCode()</li>
 * <li> Class-specific extensions to get and set the value as a basic
java data type (int, boolean, etc.)</li>
 * </ul>
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public interface
HLAarraydatatype
   extends HLAdatatype,
           java.util.List
{
   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   Class
   getElementClass();

   /**
    * Returns a boolean which is <code>true</code> if the array is
dynamic.
    * @return a boolean which is true if the array is dynamic
    */
   boolean
   isDynamic();
}
//end HLAarraydatatype
```

```
// File: HLAarrayType.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Abstract ancestor for the type-safe array data types.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAarrayType
   extends java.util.AbstractList // thus implements java.util.List
   implements java.io.Serializable,
              java.lang.Cloneable,
              java.util.RandomAccess,
              HLAarraydatatype
{
   //If at all possible, it is strongly recommended that the concrete
class declare this field:

// public static final int
// octetBoundary = <whatever>;

   //HLAdatatype interface implementation

   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    * @return how many bytes were written to the buffer, including any
prefix padding bytes
    */
   public int
   encode(byte[] buffer,
          int    offset)
   {
      return encode(new ByteWrapper(buffer, offset)).pos() - offset;
   }
   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      //Variable arrays prefix the encode with the number of elements;
      //static arrays do not
      if (isDynamic()) (new
HLAinteger32BE(size())).encode(byteWrapper);
      //And then one just encodes the individual elements
      Iterator i = iterator();
      while (i.hasNext())
((HLAdatatype)(i.next())).encode(byteWrapper);
      return byteWrapper;
   }

   /**
    * Encodes <code>this</code> into a new <code>byte[]</code>.
    * @return a <code>byte[]</code> encoding <code>this</code>
    */
   public byte[]
   toByteArray()
   {
      return encode(new ByteWrapper(encodedLength())).array();
   }

   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the data type
    * @return how many bytes were read from the <code>byte[]</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer)
      throws CouldNotDecode
   {
      return decode(buffer, 0);
   }
   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> <code>this</code>
representation begins
    * @return where in the <code>buffer</code> <code>this</code>
representation ends
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode
   {
      try
      {
         return decode(new ByteWrapper(buffer, offset)).pos();
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         int count;
//       java.lang.reflect.Constructor cons =
getElementClass().getConstructor(new Class[] {
Class.forName("ca.gc.drdc_rddc.hla.rti1516.ByteWrapper") });
         java.lang.reflect.Constructor cons =
getElementClass().getConstructor(new Class[] { ByteWrapper.class });
```

```
         byteWrapper.align(octetBoundary());
         if (isDynamic())
         {
            //Dynamic arrays
            clear();
            //First we read the number of elements to decode
            count = byteWrapper.getInt();
            //Then we decode the individual elements
            for (int i = 0; i < count; i++) add(cons.newInstance(new
Object[] { byteWrapper }));
         }
         else
         {
            //Static arrays
            count = size();
            //Decode the individual elements
            for (int i = 0; i < count; i++) set(i,
cons.newInstance(new Object[] { byteWrapper }));
         }
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   //java.lang.Object methods

   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (!super.equals(otherObject)) return false;
      //At this point, we know both this and otherObject implement the
List interface
      //and have the same iteration of elements (using equals at their
level)
      //All we need do here is make sure otherObject is of this' class
      return this.getClass().equals(otherObject.getClass());
   }
   //Cloneable implementation

   /**
    * Creates and returns a copy of this object.
    * @return an independent copy of this Object
    * @throws CloneNotSupportedException if the object's class is not
Cloneable or if the instance cannot be cloned
    */
   public Object
   clone()
      throws CloneNotSupportedException
   {
//    throw new CloneNotSupportedException();
      return super.clone();
   }
}
//end HLAarrayType
```

```
// File: HLAfixedArrayType.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

/**
 * Abstract ancestor for the type-safe fixed array data types.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAfixedArrayType
   extends HLAarrayType
{
   //HLAarraydatatype interface implementation

   //Being based on java.util.AbstractList, concrete fixed array
classes will need to
   //provide implementations for:
   //get(int index)
   //size()
   //set(int index, Object element)
   //You should provide two constructors (void and collection
arguments).
   //You do not have to provide an Iterator implementation.
   //List methods may be overridden if a more efficient implementation
is possible.

   /**
    * Returns a boolean which is <code>true</code> if the array is
dynamic.
    * @return a boolean which is true if the array is dynamic
    */
   public final boolean
   isDynamic()
   {
      return false;
   }
}
//end HLAfixedArrayType
```

```
// File: HLAvariableArrayType.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

/**
 * Abstract ancestor for the type-safe dynamic array data types.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAvariableArrayType
   extends HLAarrayType
{
   //HLAarraydatatype interface implementation

   //Being based on java.util.AbstractList, concrete variable array
classes will need to
   //provide implementations for:
   //get(int index)
   //size()
   //set(int index, Object element)
   //add(int index, Object element)
   //remove(int index)
   //You should provide two constructors (void and collection
arguments).
   //You do not have to provide an Iterator implementation.
   //List methods may be overridden if a more efficient implementation
is possible.

   /**
    * Returns a boolean which is <code>true</code> if the array is
dynamic.
    * @return a boolean which is true if the array is dynamic
    */
   public final boolean
   isDynamic()
   {
      return true;
   }
}
//end HLAvariableArrayType
```

We implement the OMT's `HLAopaqueData`, `HLAASCIIstring` and `HLAunicodeString`, grouping the last two under the abstract `HLAstring` class. Our concrete `HLAobjectArray` will serve as ancestor for most remaining array datatypes.

```
// File: HLAopaqueData.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;
import java.util.Iterator;

/**
 * Type-safe variable byte array data type.
 * It uses <code>HLAbyte</code> elements and a Java
<code>byte[]</code> internally.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAopaqueData
   extends HLAvariableArrayType
{
   /** Octet boundary of this class. */
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;

   /** The array of bytes. */
   protected transient byte[] _values;

   /**
    * Constructs an empty <code>HLAopaqueData</code>.
    */
   public
   HLAopaqueData()
   {
      //super() not called because super-class is abstract
      _values = new byte[0];
   }
   /**
    * Constructs an <code>HLAopaqueData</code> from a Collection of
HLAbyte.
    * @param c a Collection of HLAbyte objects
    */
   public
   HLAopaqueData(Collection c)
   {
      //We could start with an empty _values (by invoking this())
      //and then add() using the c.iterator(), but that is relatively
inefficient.
      _values = new byte[c.size()];
      Iterator it = c.iterator();
      for (int i = 0; it.hasNext(); i++)
      {
         set(i, it.next());
      }
   }

   /**
    * Constructs an <code>HLAopaqueData</code> containing the
specified byte value.
    * @param value a byte specifying <code>this</code>' value
    */
   public
   HLAopaqueData(byte value)
   {
      this();
      add(new Byte(value));
   }

   /**
    * Creates an <code>HLAopaqueData</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAopaqueData</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAopaqueData(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates an <code>HLAopaqueData</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAopaqueData</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAopaqueData</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAopaqueData(byte[] buffer,
                 int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates an <code>HLAopaqueData</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAopaqueData</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAopaqueData(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Sets the size of the array to the specified value.
    * Reducing the size will result in the loss of the "chopped off"
bytes.
    * @param newSize an int specifying the array's desired new size
    */
   protected void
   setSize(int newSize)
   {
      modCount++;
      int bytesToCopy = _values.length;
      if (newSize < bytesToCopy) bytesToCopy = newSize;
      byte oldValues[] = _values;
      _values = new byte[newSize];
      System.arraycopy(oldValues, 0, _values, 0, bytesToCopy);
   }
   //List interface implementation

   /**
    * Inserts the specified element at the specified position in this
array.
    * Elements must be compatible with HLAbyte; this is why this
implementation accepts only Byte and HLAoctet (and their descendants).
    * @param index an int indicating the position before which to
insert the element
    * @param element an Object to insert before index
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws ClassCastException if the class of the specified element
prevents it from being added to this list
    * @throws NullPointerException if the specified element is null
and this list does not support null elements
    * @throws IllegalArgumentException if some aspect of this element
prevents it from being added to this list
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public void
   add(int    index,
       Object element)
   {
      if ((index > size()) || (index < 0)) throw new
IndexOutOfBoundsException(Integer.toString(index));
      if (element == null) throw new NullPointerException();
      byte value;
      if (element instanceof Byte)
      {
         value = ((Byte)element).byteValue();
      }
      else if (element instanceof HLAoctet)
      {
         value = ((HLAoctet)element).getValue();
      }
      else
      {
         throw new ClassCastException(element.getClass().toString());
      }
      setSize(size() + 1); //increments modCount
      System.arraycopy(_values, index, _values, index + 1, size() -
(index + 1));
      _values[index] = value;
   }
   /**
    * Inserts all of the elements in the specified collection into
this array at the specified position.
    * @param index an int indicating before which element to insert
the collection
    * @param c a Collection of elements to insert
    * @return a boolean which is true if this array changed as a
result of this call
    * @throws IllegalArgumentException if any character to append is
not in the 00..7F range
    */
   public boolean
   addAll(int        index,
          Collection c)
   //This implementation preserves the array if the method ends
abnormally
   {
     boolean modified = false;
      //Presume abnormal termination
     boolean abnormal = true;
      //Preserve the old array and modCount
      byte oldValues[] = new byte[size()];
      System.arraycopy(_values, 0, oldValues, 0, size());
      int m = modCount;
      try
      {
         modified = super.addAll(index, c);
         abnormal = false;
      }
      finally
      {
         if (abnormal)
         {
            //If any of the add() failed, restore the old String and
modCount
            _values = oldValues;
            modCount = m;
            modified = false;
         }
      }
      return modified; //If one has a return within a finally, one
gets a warning
   }

   /**
    * Removes all of the elements from this array.
    */
   public void
   clear()
   //This implementation is more efficient than AbstractList.clear()
   {
      _values = new byte[0];
      //Provide fail-fast iterators (and list iterators)
      modCount++;
   }
   /**
    * Returns the element (a Byte) at the specified position in this
array.
    * @param index an int specifying the element to return
    * @return the requested Object (a Byte)
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   get(int index)
   {
      return new HLAbyte(_values[index]);
   }

   /**
    * Removes the element at the specified position in this array and
returns it.
    * @param index an int indicating the position from which to remove
the element
    * @return the element that was removed from the list
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   remove(int index)
   {
      if ((index > size()) || (index < 0)) throw new
IndexOutOfBoundsException(Integer.toString(index));
      Object o = get(index);
      System.arraycopy(_values, index + 1, _values, index, size() -
(index + 1));
      setSize(size() - 1); //increments modCount
      return o;
   }
   /**
    * Replaces the element at the specified position in this array
with the specified element.
    * The element must be compatible with HLAbyte; this is why this
implementation accepts only Byte and HLAoctet (and their descendants).
    * @param index an int specifying the index of the element to
replace
    * @param element the Object to use in replacing the element
    * @return the element previously at the specified position
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws ClassCastException if the class of the specified element
prevents it from being added to this list
    * @throws NullPointerException if the specified element is null
and this list does not support null elements
    * @throws IllegalArgumentException if some aspect of the specified
element prevents it from being added to this list
    * @throws IndexOutOfBoundsException if the index is outside the
[0..size()[ range
    */
   public Object
   set(int    index,
       Object element)
   {
      if ((index > size()) || (index < 0)) throw new
IndexOutOfBoundsException(Integer.toString(index));
      if (element == null) throw new NullPointerException();
      byte value;
      if (element instanceof Byte)
      {
         value = ((Byte)element).byteValue();
      }
      else if (element instanceof HLAoctet)
      {
         value = ((HLAoctet)element).getValue();
      }
      else
      {
         throw new ClassCastException(element.getClass().toString());
      }
      Object o = get(index);
      _values[index] = value;
      //Note that set() does not modify the array <i>structurally</i>
      return o;
   }

   /**
    * Returns the number of elements in this array.
    * @return an int specifying the number of elements in this array
    */
   public int
   size()
   {
      return _values.length;
   }
   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * Here we choose to use the form "[ xx xx ]" where xx is the
hexadecimal representation of each byte.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      String s = " ";
      Iterator i = iterator();
      while (i.hasNext()) s = s +
Integer.toHexString((int)((HLAoctet)i.next()).getValue()) + " ";
      return "[" + s + "]";
   }

   //HLAdatatype interface implementation

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * This implementation is more efficient than the ancestor's.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      (new HLAinteger32BE(size())).encode(byteWrapper);
      byteWrapper.read(_values);
      return byteWrapper;
   }

   /**
    * Encodes <code>this</code> into a new <code>byte[]</code>.
    * This implementation is more efficient than the ancestor's.
    * @return a <code>byte[]</code> encoding <code>this</code>
    */
   public byte[]
   toByteArray()
   {
      return _values;
   }
   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * This implementation is more efficient than the ancestor's.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         //First we read the number of elements to decode
         int count = byteWrapper.getInt();
         setSize(count); //increments modCount
         //Then we decode the individual elements
         byteWrapper.write(_values);
         return byteWrapper;
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * <p>
    * As a general rule, Variant Records [HLAvariantRecord], Dynamic
Arrays [HLAvariableArray], and any
    * Fixed Arrays [HLAfixedArray] or Fixed Records [HLAfixedRecord]
containing either of these first two
    * cannot have a constant encodedLength.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      return HLAinteger32BE.encodedLength + size();
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * For dynamic arrays, octet boundary is thus the largest of the
count (an HLAinteger32BE) and the element.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   //HLAarraydatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAbyte.class;
   }
}
//end HLAopaqueData
```

```
// File: HLAstring.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
//import java.util.Collection;

/**
 * Type-safe abstract String variable array data type.
 * It uses <code>char</code> elements and a Java <code>String</code>
internally;
 * it is the ancestor of the HLAASCIIstring and HLAunicodeString
concrete classes.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public abstract class
HLAstring
   extends HLAvariableArrayType
{
   /** Octet boundary of this class. */
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;

   /** The String variable array: a Java String. */
   protected String _value;
   //List interface implementation

   /**
    * Inserts the specified element at the specified position in this
array.
    * Elements must be compatible with HLAunicodeChar; this is true as
long as the element's toString() method
    * returns a non-zero length String. Zero-length Strings are not
acceptable.
    * @param index an int indicating the position before which to
insert the element
    * @param element an Object to insert before index
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws ClassCastException if the class of the specified element
prevents it from being added to this list
    * @throws NullPointerException if the specified element is null
and this list does not support null elements
    * @throws IllegalArgumentException if some aspect of this element
prevents it from being added to this list
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public void
   add(int    index,
       Object element)
   {
      try
      {
         _value = _value.substring(0, index) +
verify(element.toString().substring(0, 1)) + _value.substring(index);
      }
      catch (IndexOutOfBoundsException e)
      {
         //element.toString() must have returned a zero-length String
         IllegalArgumentException iae = new
IllegalArgumentException(e.getMessage());
         throw (IllegalArgumentException)iae.initCause(e);
      }
      //Provide fail-fast iterators (and list iterators)
      modCount++;
   }
   /**
    * Inserts all of the elements in the specified collection into
this array at the specified position.
    * @param index an int indicating before which element to insert
the collection
    * @param c a Collection of elements to append
    * @return a boolean which is true if this array changed as a
result of this call
    * @throws IllegalArgumentException if any character to append is
not in the 00..7F range
    */
   public boolean
   addAll(int        index,
          Collection c)
   //This implementation preserves the array if the method ends
abnormally
   {
      boolean modified = false;
      //Presume abnormal termination
      boolean abnormal = true;
      //Preserve the old String and modCount
      String s = _value;
      //Strings are immutable, so although s and _value now reference
the same object,
      //changing _value later will change the _value reference away
from s
      int m = modCount;
      try
      {
         modified = super.addAll(index, c);
         abnormal = false;
      }
      finally
      {
         if (abnormal)
         {
            //If any of the add() failed, restore the old String and
modCount
            _value = s;
            modCount = m;
            modified = false;
         }
      }
      return modified; //If one has a return within a finally, one
gets a warning
   }
   /**
    * Removes all of the elements from this array.
    */
   public void
   clear()
   //This implementation is more efficient than AbstractList.clear()
   {
      _value = "";
      //Provide fail-fast iterators (and list iterators)
      modCount++;
   }

   /**
    * Returns true if this array contains the specified element.
    * The method looks for Object.toString().substring(0, 1) in the
array.
    * A zero-length String element will return false.
    * @param o the Object sought in the array
    * @return a boolean which is true if the array contains
o.toString().charAt(0)
    */
   public boolean
   contains(Object o)
   //This implementation is more efficient than
AbstractCollection.contains(Object)
   //I'm a little surprised this isn't in AbstractList already...
   {
      return (indexOf(o) > -1);
   }

   /**
    * Returns the element (a char) at the specified position in this
array.
    * @param index an int specifying the element to return
    * @return the requested Object (a char)
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   get(int index)
   {
      return new Character(_value.charAt(index));
   }
   /**
    * Returns the index in this array of the first occurrence of the
specified element,
    * or -1 if this array does not contain this element (zero-length
Strings will return -1).
    * @param o the Object whose toString() is sought
    * @return the index of the first occurrence of the specified
element (-1 if not found)
    */
   public int
   indexOf(Object o)
   //This implementation is more efficient than
AbstractList.indexOf(Object)
   {
      if (o.toString().length() <= 0) return -1;
      return _value.indexOf(o.toString().substring(0, 1));
   }

   /**
    * Returns the index in this array of the last occurrence of the
specified element,
    * or -1 if this array does not contain this element (zero-length
Strings will return -1).
    * @param o the Object sought
    * @return an int specifying the last occurrence of the specified
element (-1 if not found)
    */
   public int
   lastIndexOf(Object o)
   //This implementation is more efficient than
AbstractList.lastIndexOf(Object)
   {
      if (o.toString().length() <= 0) return -1;
      return _value.lastIndexOf(o.toString().substring(0, 1));
   }

   /**
    * Removes the element at the specified position in this array and
returns it.
    * @param index an int indicating the position from which to remove
the element
    * @return the element that was removed from the list
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   remove(int index)
   {
      Object o = get(index);
      _value = _value.substring(0, index) + _value.substring(index +
1);
      //Provide fail-fast iterators (and list iterators)
      modCount++;
      return o;
   }
   /**
    * Retains only the elements in this array that are contained in
the specified collection.
    * The AbstractCollection implementation clarifies the semantics as
follows:
    * One should iterate over the list and, for each element not
contained in the collection, remove it.
    * This means all elements that appear at least once in the
collection are retained,
    * and that the list retains its original sort order.
    * @param c the Collection of elements to retain from this array
    * @return a boolean which is true if this has changed
    * @throws UnsupportedOperationException if this method is not
supported
    * @throws ClassCastException if the elements of the array and
collection are incompatible
    * @throws NullPointerException if the specified collection is null
    */
// public boolean
// retainAll(Collection c)
   //Provided by AbstractCollection

   /**
    * Replaces the element at the specified position in this array
with the specified element.
    * @param index an int specifying the index of the element to
replace
    * @param element the Object to use in replacing the element
    * @return the element previously at the specified position
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws ClassCastException if the class of the specified element
prevents it from being added to this list
    * @throws NullPointerException if the specified element is null
and this list does not support null elements
    * @throws IllegalArgumentException if some aspect of the specified
element prevents it from being added to this list
    * @throws IndexOutOfBoundsException if the index is outside the
[0..size()[ range
    */
   public Object
   set(int    index,
       Object element)
   {
      if (element.toString().length() <= 0) throw new
IllegalArgumentException();
      Object o = get(index);
      _value = _value.substring(0, index) +
verify(element.toString().substring(0, 1)) + _value.substring(index +
1);
      //Note that set() does not modify the array <i>structurally</i>
      return o;
   }
   /**
    * Returns the number of elements in this array.
    * @return an int specifying the number of elements in this array
    */
   public int
   size()
   {
      return _value.length();
   }

   //java.lang.Object methods

   /**
    * Returns a <code>String</code> representation of
<code>this</code>.
    * @return a {@link java.lang.String} reflecting <code>this</code>
value
    */
   public String
   toString()
   {
      return _value;
   }

   //HLAdatatype interface implementation

   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * For dynamic arrays, octet boundary is thus the largest of the
count (an HLAinteger32BE) and the element.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      return octetBoundary;
   }

   //Class-specific extensions

   /**
    * Verifies if the String value is acceptable.
    * @param value the String to verify
    * @return the String value
    * @throws IllegalArgumentException if any character in the value
is unacceptable
    */
   protected abstract String
   verify(String value)
      throws IllegalArgumentException;
   /**
    * Returns the String value of <code>this</code>.
    * @return the String value of <code>this</code>
    * @see #setValue
    */
   public String
   getValue()
   {
      return _value;
   }

   /**
    * Sets the String value of <code>this</code>.
    * @param value the String new value for <code>this</code>
    * @throws IllegalArgumentException if the value isn't Unicode
    * @see #getValue
    */
   public void
   setValue(String value)
   {
      _value = verify(value);
      //Provide fail-fast iterators (and list iterators)
      modCount++;
   }

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return char.class;
   }
}
//end HLAstring
```

```
// File: HLAASCIIstring.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe ASCII string variable array data type.
 * It uses <code>HLAASCIIchar</code> elements.
 * A Java <code>String</code> is used internally.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAASCIIstring
   extends HLAstring
{
   /**
    * Constructs a <code>HLAASCIIstring</code> of default value (empty
ASCII string).
    */
   public
   HLAASCIIstring()
   {
      //super() not called because HLAstring is abstract
      setValue("");
   }

   /**
    * Constructs a <code>HLAASCIIstring</code> from the specified
Collection.
    * An exception occurs if the Collection doesn't return a series of
ASCII characters.
    * @param c a Collection specifying <code>this</code>' value
    * @throws IllegalArgumentException if value isn't ASCII (all
characters in numeric range 0..127)
    */
   public
   HLAASCIIstring(Collection c)
      throws IllegalArgumentException
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      this();
      addAll(c);
   }
   /**
    * Constructs a <code>HLAASCIIstring</code> from the specified
String value.
    * An exception occurs if any part of value String is not ASCII.
    * @param value a String specifying <code>this</code>' value
    * @throws IllegalArgumentException if value isn't ASCII (all
characters in numeric range 0..127)
    */
   public
   HLAASCIIstring(String value)
      throws IllegalArgumentException
   {
      this();
      setValue(value);
   }

   /**
    * Constructs a <code>HLAASCIIstring</code> from the specified
Object.
    * @param o an Object whose toString() specifies <code>this</code>
    */
   public
   HLAASCIIstring(Object o)
   {
      this();
      setValue(o.toString());
   }

   /**
    * Creates a <code>HLAASCIIstring</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAASCIIstring</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAASCIIstring(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAASCIIstring</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAASCIIstring</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAASCIIstring</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAASCIIstring(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAASCIIstring</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAASCIIstring</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAASCIIstring(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   /**
    * Verifies if the String value is ASCII.
    * @param value the String to verify
    * @return the value String
    * @throws IllegalArgumentException if any character in the value
is not in the 00..7F range
    */
   protected final String
   verify(String value)
      throws IllegalArgumentException
   {
      for (int i = 0; i < value.length(); i++)
HLAASCIIchar.verify(value.charAt(i));
//    {
//       if (value.charAt(i) < 0x0080) continue;
//       if (value.charAt(i) > 0x0FFF)
//       {
//         throw new IllegalArgumentException("[" + i + "] = 0x"   +
Integer.toHexString((int)value.charAt(i)));
//       }
//       else if (value.charAt(i) > 0x00FF)
//       {
//         throw new IllegalArgumentException("[" + i + "] = 0x0"  +
Integer.toHexString((int)value.charAt(i)));
//       }
//       else // (value.charAt(i) > 0x007F)
//       {
//         throw new IllegalArgumentException("[" + i + "] = 0x00" +
Integer.toHexString((int)value.charAt(i)));
//       }
//    }
      return value;
   }

   //List interface implementation

   /**
    * Returns the element (an HLAASCIIchar) at the specified position
in this array.
    * @param index an int specifying the element to return
    * @return the requested Object (an HLAASCIIchar)
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   get(int index)
   {
      return new HLAASCIIchar(super.get(index));
   }
   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength()
   {
//    return HLAinteger32BE.encodedLength + size();
      return HLAinteger32BE.encodedLength +
HLAASCIIchar.encodedLength*size();
   }

   public Class
   getElementClass()
   {
      return HLAASCIIchar.class;
   }
}
//end HLAASCIIstring
```

```
// File: HLAunicodeString.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe Unicode string variable array data type.
 * It uses <code>HLAunicodeChar</code> elements.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAunicodeString
   extends HLAstring
{
   /**
    * Constructs a <code>HLAunicodeString</code> of default value
(empty Unicode string).
    */
   public
   HLAunicodeString()
   {
      //super() not called because HLAstring is abstract
      setValue("");
   }

   /**
    * Constructs a <code>HLAunicodeString</code> from the specified
Collection.
    * An exception occurs if the Collection doesn't return a series of
Unicode characters.
    * @param c a Collection specifying <code>this</code>' value
    * @throws IllegalArgumentException if value isn't Unicode
    */
   public
   HLAunicodeString(Collection c)
      throws IllegalArgumentException
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      this();
      addAll(c);
   }
   /**
    * Constructs a <code>HLAunicodeString</code> from the specified
String value.
    * An exception occurs if any part of value String is not Unicode.
    * @param value a String specifying <code>this</code>' value
    * @throws IllegalArgumentException if value isn't Unicode
    */
   public
   HLAunicodeString(String value)
      throws IllegalArgumentException
   {
      this();
      setValue(value);
   }

   /**
    * Constructs a <code>HLAunicodeString</code> from the specified
Object.
    * @param o an Object whose toString() specifies <code>this</code>
    */
   public
   HLAunicodeString(Object o)
   {
      this();
      setValue(o.toString());
   }

   /**
    * Creates a <code>HLAunicodeString</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAunicodeString</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAunicodeString(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>HLAunicodeString</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAunicodeString</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAunicodeString</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAunicodeString(byte[] buffer,
                    int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>HLAunicodeString</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAunicodeString</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAunicodeString(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Verifies if the String value is acceptable.
    * @param value the String to verify
    * @return the String value
    * @throws IllegalArgumentException if any character in the value
is unacceptable
    */
   protected String
   verify(String value)
      throws IllegalArgumentException
   {
      //All Java Strings are acceptable because they are Unicode
      return value;
   }
   //List interface implementation

   /**
    * Returns the element (an HLAunicodeChar) at the specified
position in this array.
    * @param index an int specifying the element to return
    * @return the requested Object (an HLAunicodeChar)
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   get(int index)
   {
      return new HLAunicodeChar(super.get(index));
   }

   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength()
   {
//    return HLAinteger32BE.encodedLength() + 2*size();
      return HLAinteger32BE.encodedLength +
HLAunicodeChar.encodedLength*size();
   }

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAunicodeChar.class;
   }
}
//end HLAunicodeString
```

```
// File: HLAobjectArray.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;
import java.util.Iterator;

/**
 * Type-safe variable HLAnull array data type.
 * It uses <code>HLAnull</code> elements and a Java
<code>Object[]</code> internally.
 * It is designed as a generic concrete ancestor to various non-basic
data type HLA variable arrays.
 * <p>
 * Instead of using the HLAdatatype interface as element class, we
used HLAnull,
 * simply in order to make this decodable.
 * <p>
 * The HLAunicodeString and HLAopaqueData classes use String and
byte[], respectively,
 * to store HLAunicodeChar and HLAbyte elements, respectively, so
their implementations
 * are different in order to be more efficient.
 * <p>
 * Descendant array types need only supply constructors that invoke
super,
 * and override List methods when better implementations are possible.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAobjectArray
   extends HLAvariableArrayType
{
   /** Octet boundary of this class. */
   //The element count is HLAinteger32BE.octetBoundary, but the
elements
   //themselves may be wider (e.g. an array of HLAinteger64BE),
   //in which case this field should be redeclared
   public static final int
   octetBoundary = HLAinteger32BE.octetBoundary;

   /** The array of Objects. */
   protected transient Object[] _values;

   /**
    * Constructs an empty <code>HLAobjectArray</code>.
    */
   public
   HLAobjectArray()
   {
      //super() not called because super-class is abstract
      _values = new Object[0];
   }
   /**
    * Constructs an <code>HLAobjectArray</code> from a Collection of
Objects.
    * @param c a Collection of Objects
    */
   public
   HLAobjectArray(Collection c)
   {
      //super() not called because super-class is abstract
      //We could start with an empty _values (by invoking this())
      //and then add() using the c.iterator(), but that is relatively
inefficient.
      _values = new Object[c.size()];
      Iterator it = c.iterator();
      for (int i = 0; it.hasNext(); i++)
      {
         set(i, it.next());
      }
   }

   /**
    * Constructs an <code>HLAobjectArray</code> containing the
specified Object reference.
    * The Object must be of the element class or a descendant.
    * @param o an Object specifying <code>this</code>' value
    */
   public
   HLAobjectArray(Object o)
   {
      this();
      add(o);
   }

   /**
    * Creates an <code>HLAobjectArray</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAobjectArray</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAobjectArray(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates an <code>HLAobjectArray</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAobjectArray</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAobjectArray</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAobjectArray(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates an <code>HLAobjectArray</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAobjectArray</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAobjectArray(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Sets the size of the array to the specified value.
    * Reducing the size will result in the loss of the "chopped off"
bytes.
    * @param newSize an int specifying the array's desired new size
    */
   protected void
   setSize(int newSize)
   {
      modCount++;
      int objectsToCopy = _values.length;
      if (newSize < objectsToCopy) objectsToCopy = newSize;
      Object oldValues[] = _values;
      _values = new Object[newSize];
      System.arraycopy(oldValues, 0, _values, 0, objectsToCopy);
   }
   //List interface implementation

   /**
    * Inserts the specified element at the specified position in this
array.
    * Elements must be compatible with the array's element data type.
    * @param index an int indicating the position before which to
insert the element
    * @param element an Object to insert before index
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws ClassCastException if the class of the specified element
prevents it from being added to this list
    * @throws NullPointerException if the specified element is null
and this list does not support null elements
    * @throws IllegalArgumentException if some aspect of this element
prevents it from being added to this list
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public void
   add(int    index,
       Object element)
   {
      if ((index > size()) || (index < 0)) throw new
IndexOutOfBoundsException(Integer.toString(index));
      if (element == null) throw new NullPointerException();
//    if (!(element instanceof <element class>))
//    if (!getElementClass().isAssignableFrom(element.getClass()))
//same as:
      if (!getElementClass().isInstance(element)) //true if element is
of getElementClass or a sub-class
//    if (!getElementClass().equals(element.getClass())) //true only
if classes match exactly
      {
         throw new ClassCastException(element.getClass().toString());
      }
      setSize(size() + 1); //increments modCount
      System.arraycopy(_values, index, _values, index + 1, size() -
(index + 1));
      _values[index] = element;
   }
   /**
    * Inserts all of the elements in the specified collection into
this array at the specified position.
    * @param index an int indicating before which element to insert
the collection
    * @param c a Collection of elements to insert
    * @return a boolean which is true if this array changed as a
result of this call
    * @throws IllegalArgumentException if some aspect of this element
prevents it from being added to this list
    */
   public boolean
   addAll(int        index,
          Collection c)
   //This implementation preserves the array if the method ends
abnormally
   {
      boolean modified = false;
      //Presume abnormal termination
      boolean abnormal = true;
      //Preserve the old array and modCount
      Object oldValues[] = new Object[size()];
      System.arraycopy(_values, 0, oldValues, 0, size());
      int m = modCount;
      try
      {
         modified = super.addAll(index, c);
         abnormal = false;
      }
      finally
      {
         if (abnormal)
         {
            //If any of the add() failed, restore the old String and
modCount
            _values = oldValues;
            modCount = m;
            modified = false;
         }
      }
      return modified; //If one has a return within a finally, one
gets a warning
   }

   /**
    * Removes all of the elements from this array.
    */
   public void
   clear()
   //This implementation is more efficient than AbstractList.clear()
   {
      _values = new Object[0];
      //Provide fail-fast iterators (and list iterators)
      modCount++;
   }
   /**
    * Returns the element (as an Object) at the specified position in
this array.
    * @param index an int specifying the element to return
    * @return the requested Object
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   get(int index)
   {
      return _values[index];
   }

   /**
    * Removes the element at the specified position in this array and
returns it.
    * @param index an int indicating the position from which to remove
the element
    * @return the element that was removed from the list
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws IndexOutOfBoundsException if <code>index</code> is
negative or larger than <code>size()</code>
    */
   public Object
   remove(int index)
   {
      if ((index > size()) || (index < 0)) throw new
IndexOutOfBoundsException(Integer.toString(index));
      Object o = get(index);
      System.arraycopy(_values, index + 1, _values, index, size() -
(index + 1));
      setSize(size() - 1); //increments modCount
      return o;
   }
   /**
    * Replaces the element at the specified position in this array
with the specified element.
    * The element must be compatible with the element class.
    * @param index an int specifying the index of the element to
replace
    * @param element the Object to use in replacing the element
    * @return the element previously at the specified position
    * @throws UnsupportedOperationException if this method is not
supported by this list
    * @throws ClassCastException if the class of the specified element
prevents it from being added to this list
    * @throws NullPointerException if the specified element is null
and this list does not support null elements
    * @throws IllegalArgumentException if some aspect of the specified
element prevents it from being added to this list
    * @throws IndexOutOfBoundsException if the index is outside the
[0..size()[ range
    */
   public Object
   set(int    index,
       Object element)
   {
      if ((index > size()) || (index < 0)) throw new
IndexOutOfBoundsException(Integer.toString(index));
      if (element == null) throw new NullPointerException();
//    if (!(element instanceof <element class>))
//    if (!getElementClass().isAssignableFrom(element.getClass()))
//same as:
      if (!getElementClass().isInstance(element)) //true if element is
of getElementClass or a sub-class
//    if (!getElementClass().equals(element.getClass())) //true only
if classes match exactly
      {
         throw new ClassCastException(element.getClass().toString());
      }
      Object o = get(index);
      _values[index] = element;
      //Note that set() does not modify the array <i>structurally</i>
      return o;
   }

   /**
    * Returns the number of elements in this array.
    * @return an int specifying the number of elements in this array
    */
   public int
   size()
   {
      return _values.length;
   }
   //HLAdatatype interface implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * <p>
    * As a general rule, Variant Records [HLAvariantRecord], Dynamic
Arrays [HLAvariableArray], and any
    * Fixed Arrays [HLAfixedArray] or Fixed Records [HLAfixedRecord]
containing either of these first two
    * cannot have a constant encodedLength.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public int
   encodedLength()
   {
      //If the element has a fixed size, we can predict the encoded
size;
      //such arrays should override this implementation
      HLAdatatype element;
      //Encoding starts with the element count
      int theLength = HLAinteger32BE.encodedLength;
      for (int i = 0; i < size(); i++)
      {
         //Each element is encoded after being aligned to its
octetBoundary
         element = (HLAdatatype)get(i);
         while ((theLength % element.octetBoundary()) != 0)
theLength++;
         theLength += element.encodedLength();
      } //for
      //Note that the last element won't be padded
      return theLength;
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * For dynamic arrays, octet boundary is thus the largest of the
count (an HLAinteger32BE) and the element.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      //If "this" has a static octetBoundary field, use it
      Object o = getThisClassField(this.getClass(), "octetBoundary");
      if (o != null) return ((Integer)o).intValue();
      int cw = HLAinteger32BE.octetBoundary; //element counter's
octetBoundary
      int ew = 0;
      //Dynamically compare with the element octetBoundary
      o = getThisClassField(getElementClass(), "octetBoundary");
      if (o != null)
      {
         ew = ((Integer)o).intValue();
      } else {
         //Element class did not have a static octetBoundary
         //Must needs invoke an element instance's octetBoundary
method instead
         if (size() > 0)
         {
            //Use the first element
            o = get(0);
         } else {
            //Construct a throwaway default element
            try
            {
               o = getElementClass().newInstance();
            } catch (Exception e) { //InstantiationException,
IllegalAccessException
               //Give up!
               return cw;
            }
         }
         ew = ((HLAdatatype)o).octetBoundary();
      }
      return (ew > cw) ? ew : cw;
   }
   //HLAarraydatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
//    return HLAdatatype.class; //HLAdatatype is an interface, so it
has no constructor --hence decode fails
      return HLAnull.class;
   }

   //Supporting classes and methods

   /**
    * Returns the specified (static) field's value of the specified
Class as an Object.
    * @param aClass the Class whose static field is looked up
    * @param fieldName a String specifying the field's name
    * @return the requested field value, as an Object (null in case of
failure)
    */
   private Object
   getThisClassField(Class aClass, String fieldName)
   {
      try {
         return aClass.getField(fieldName).get(null);
      } catch (Exception e) { //NoSuchFieldException,
IllegalAccessException
         return null;
      }
   }
}
//end HLAobjectArray
```

The MOM array datatypes descend from `HLAunicodeString` (`HLAtransportationName`), `HLAopaqueData` (`HLAhandle`, `HLAlogicalTime`, and `HLAtimeInterval`), or `HLAobjectArray` (the remaining seven). The first four simply declare constructors and do nothing else. The last seven additionally override the `getElementClass` method (`HLAobjectArray` does the rest).

```
// File: HLAtransportationName.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe transportation name (Unicode string) variable array data
type.
 * It is essentially identical to <code>HLAunicodeString</code>
elements,
 * with an added convenience constructor.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAtransportationName
   extends HLAunicodeString
{
   /**
    * Constructs a <code>HLAtransportationName</code> of default value
(empty Unicode string).
    */
   public
   HLAtransportationName()
   {
      super();
   }

   /**
    * Constructs a <code>HLAtransportationName</code> from the
specified Collection.
    * An exception occurs if the Collection doesn't return a series of
Unicode characters.
    * @param c a Collection specifying <code>this</code>' value
    * @throws IllegalArgumentException if value isn't Unicode
    */
   public
   HLAtransportationName(Collection c)
      throws IllegalArgumentException
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs a <code>HLAtransportationName</code> from the
specified String value.
    * An exception occurs if any part of value String is not Unicode.
    * @param value a String specifying <code>this</code>' value
    * @throws IllegalArgumentException if value isn't Unicode
    */
   public
   HLAtransportationName(String value)
      throws IllegalArgumentException
   {
      super(value);
   }

   /**
    * Constructs a <code>HLAtransportationName</code> from the
specified Object.
    * @param o an Object whose toString() specifies <code>this</code>
    */
   public
   HLAtransportationName(Object o)
   {
      super(o);
   }

   /**
    * Creates a <code>HLAtransportationName</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAtransportationName</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAtransportationName(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }
   /**
    * Creates a <code>HLAtransportationName</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAtransportationName</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAunicodeString</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAtransportationName(byte[] buffer,
                         int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }

   /**
    * Creates a <code>HLAtransportationName</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAtransportationName</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAtransportationName(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }
}
//end HLAtransportationName
```

```
// File: HLAhandle.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.*; //For CouldNotDecode and the various handle
types
import java.util.Collection;
//import java.util.Iterator;

/**
 * Type-safe variable byte array data type, used to store various HLA
handle types.
 * It is essentially identical to HLAopaqueData, with added
convenience constructors for
 * AttributeHandle, DimensionHandle, FederateHandle,
InteractionClassHandle, ObjectClassHandle,
 * ObjectInstanceHandle and ParameterHandle but not
MessageRetractionHandle and RegionHandle,
 * which lack the encodedLength and encode methods.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAhandle
   extends HLAopaqueData
{
   /**
    * Constructs an empty <code>HLAhandle</code>.
    */
   public
   HLAhandle()
   {
      super();
   }

   /**
    * Constructs an <code>HLAhandle</code> from a Collection of
HLAbyte.
    * @param c a Collection of HLAbyte objects
    */
   public
   HLAhandle(Collection c)
   {
      super(c);
   }
   /**
    * Constructs an <code>HLAhandle</code> containing the specified
byte value.
    * @param value a byte specifying <code>this</code>' value
    */
   public
   HLAhandle(byte value)
   {
      super(value);
   }

   /**
    * Creates an <code>HLAhandle</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAhandle</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Creates an <code>HLAhandle</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAhandle</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAhandle</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(byte[] buffer,
             int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Creates an <code>HLAhandle</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>HLAhandle</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAhandle(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   /**
    * Constructs an <code>HLAhandle</code> containing the specified
AttributeHandle.
    * @param value an AttributeHandle specifying <code>this</code>'
value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(AttributeHandle value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }

   /**
    * Constructs an <code>HLAhandle</code> containing the specified
DimensionHandle.
    * @param value a DimensionHandle specifying <code>this</code>'
value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(DimensionHandle value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }
   /**
    * Constructs an <code>HLAhandle</code> containing the specified
FederateHandle.
    * @param value a FederateHandle specifying <code>this</code>'
value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(FederateHandle value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }

   /**
    * Constructs an <code>HLAhandle</code> containing the specified
InteractionClassHandle.
    * @param value an InteractionClassHandle specifying
<code>this</code>' value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(InteractionClassHandle value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }

   /**
    * Constructs an <code>HLAhandle</code> containing the specified
ObjectClassHandle.
    * @param value an ObjectClassHandle specifying <code>this</code>'
value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(ObjectClassHandle value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }
   /**
    * Constructs an <code>HLAhandle</code> containing the specified
ObjectInstanceHandle.
    * @param value an ObjectInstanceHandle specifying
<code>this</code>' value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(ObjectInstanceHandle value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }

   /**
    * Constructs an <code>HLAhandle</code> containing the specified
ParameterHandle.
    * @param value a ParameterHandle specifying <code>this</code>'
value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandle(ParameterHandle value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }
}
//end HLAhandle
```

```
// File: HLAlogicalTime.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.*; //For CouldNotDecode and the various handle
types
import java.util.Collection;
//import java.util.Iterator;

/**
 * Type-safe variable byte array data type, used to store a logical
time.
 * It is essentially identical to HLAopaqueData, with an added
convenience constructor for LogicalTime.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAlogicalTime
   extends HLAopaqueData
{
   /** Octet boundary of this class. */
// public final static int
// octetBoundary = HLAinteger32BE.octetBoundary;

   /**
    * Constructs an empty <code>HLAlogicalTime</code>.
    */
   public
   HLAlogicalTime()
   {
      super();
   }

   /**
    * Constructs an <code>HLAlogicalTime</code> from a Collection of
HLAbyte.
    * @param c a Collection of HLAbyte objects
    */
   public
   HLAlogicalTime(Collection c)
   {
      super(c);
   }

   /**
    * Constructs an <code>HLAlogicalTime</code> containing the
specified byte value.
    * @param value a byte specifying <code>this</code>' value
    */
   public
   HLAlogicalTime(byte value)
   {
      super(value);
   }
   /**
    * Creates an <code>HLAlogicalTime</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAlogicalTime</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAlogicalTime(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Creates an <code>HLAlogicalTime</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAlogicalTime</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAlogicalTime</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAlogicalTime(byte[] buffer,
                  int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }

   /**
    * Creates an <code>HLAlogicalTime</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAlogicalTime</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAlogicalTime(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }
   /**
    * Constructs an <code>HLAlogicalTime</code> containing the
specified LogicalTime.
    * @param value a LogicalTime specifying <code>this</code>' value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAlogicalTime(LogicalTime value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }
}
//end HLAlogicalTime
```

```
// File: HLAtimeInterval.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.*; //For CouldNotDecode and the various handle
types
import java.util.Collection;
//import java.util.Iterator;

/**
 * Type-safe variable byte array data type, used to store a logical
time interval.
 * It is essentially identical to HLAopaqueData, with an added
convenience constructor for LogicalTimeInterval.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAtimeInterval
   extends HLAopaqueData
{
   /** Octet boundary of this class. */
// public final static int
// octetBoundary = HLAinteger32BE.octetBoundary;

   /**
    * Constructs an empty <code>HLAtimeInterval</code>.
    */
   public
   HLAtimeInterval()
   {
      super();
   }

   /**
    * Constructs an <code>HLAtimeInterval</code> from a Collection of
HLAbyte.
    * @param c a Collection of HLAbyte objects
    */
   public
   HLAtimeInterval(Collection c)
   {
      super(c);
   }

   /**
    * Constructs an <code>HLAtimeInterval</code> containing the
specified byte value.
    * @param value a byte specifying <code>this</code>' value
    */
   public
   HLAtimeInterval(byte value)
   {
      super(value);
   }
   /**
    * Creates an <code>HLAtimeInterval</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAtimeInterval</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAtimeInterval(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Creates an <code>HLAtimeInterval</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAtimeInterval</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAtimeInterval</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAtimeInterval(byte[] buffer,
                   int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }

   /**
    * Creates an <code>HLAtimeInterval</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAtimeInterval</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAtimeInterval(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }
   /**
    * Constructs an <code>HLAtimeInterval</code> containing the
specified LogicalTimeInterval.
    * @param value a LogicalTimeInterval specifying <code>this</code>'
value
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAtimeInterval(LogicalTimeInterval value)
      throws CouldNotDecode
   {
      this();
      byte[] buffer = new byte[value.encodedLength()];
      value.encode(buffer, 0);
      decode(new ByteWrapper(buffer, 0));
   }
}
//end HLAtimeInterval
```

```
// File: HLAargumentList.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe MOM HLAargumentList variable array data type.
 * It uses <code>HLAunicodeString</code> elements.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAargumentList
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;

   /**
    * Constructs <code>this</code> of default value (empty array).
    */
   public
   HLAargumentList()
   {
      super();
   }

   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   HLAargumentList(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   HLAargumentList(Object o)
   {
      super(o);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAargumentList(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAargumentList(byte[] buffer,
                   int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAargumentList(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAdatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAunicodeString.class;
   }
}
//end HLAargumentList
```

```
// File: HLAhandleList.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;
//import java.util.Iterator;

/**
 * Type-safe MOM HLAhandleList variable array data type.
 * It uses <code>HLAhandle</code> elements (themselves HLAbyte
variable arrays).
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
public class
HLAhandleList
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;

   /**
    * Constructs <code>this</code> of default value (empty array).
    */
   public
   HLAhandleList()
   {
      super();
   }

   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   HLAhandleList(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   HLAhandleList(Object o)
   {
      super(o);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandleList(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAhandleList(byte[] buffer,
                 int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAhandleList(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAdatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAhandle.class;
   }
}
//end HLAhandleList
```

```
// File: HLAinteractionCounts.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe MOM HLAinteractionCounts variable array data type.
 * It uses <code>HLAinteractionCount</code> elements (themselves fixed
records).
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteractionCounts
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;
   //Fields are HLAhandle and HLAcount (both HLAinteger32BE)

   /**
    * Constructs <code>this</code> of default value (empty array).
    */
   public
   HLAinteractionCounts()
   {
      super();
   }

   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   HLAinteractionCounts(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   HLAinteractionCounts(Object o)
   {
      super(o);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionCounts(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionCounts(byte[] buffer,
                        int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteractionCounts(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAdatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteractionCount.class;
   }
}
//end HLAinteractionCounts
```

```
// File: HLAinteractionSubList.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe MOM HLAinteractionSubList variable array data type.
 * It uses <code>HLAinteractionSubscription</code> elements
(themselves fixed records).
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteractionSubList
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;
   //Fields are HLAhandle (HLAinteger32BE) and HLAboolean (likewise)

   /**
    * Constructs <code>this</code> of default value (empty array).
    */
   public
   HLAinteractionSubList()
   {
      super();
   }

   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   HLAinteractionSubList(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   HLAinteractionSubList(Object o)
   {
      super(o);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionSubList(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionSubList(byte[] buffer,
                         int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteractionSubList(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAdatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAinteractionSubscription.class;
   }
}
//end HLAinteractionSubList
```

```
// File: HLAobjectClassBasedCounts.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe MOM HLAobjectClassBasedCounts variable array data type.
 * It uses <code>HLAobjectClassBasedCount</code> elements (themselves
fixed records).
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAobjectClassBasedCounts
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;
   //Fields are HLAhandle and HLAcount (both HLAinteger32BE)

   /**
    * Constructs <code>this</code> of default value (empty array).
    */
   public
   HLAobjectClassBasedCounts()
   {
      super();
   }

   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   HLAobjectClassBasedCounts(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   HLAobjectClassBasedCounts(Object o)
   {
      super(o);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAobjectClassBasedCounts(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAobjectClassBasedCounts(byte[] buffer,
                             int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAobjectClassBasedCounts(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAdatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAobjectClassBasedCount.class;
   }
}
//end HLAobjectClassBasedCounts
```

```
// File: HLAsyncPointFederateList.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe MOM HLAsyncPointFederateList variable array data type.
 * It uses <code>HLAsyncPointFederate</code> elements (themselves
fixed records).
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAsyncPointFederateList
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;
   //Fields are HLAhandle (HLAinteger32BE) and HLAsyncPointStatus
(HLAinteger32BE enumerated)

   /**
    * Constructs <code>this</code> of default value (empty array).
    */
   public
   HLAsyncPointFederateList()
   {
      super();
   }

   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   HLAsyncPointFederateList(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   HLAsyncPointFederateList(Object o)
   {
      super(o);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointFederateList(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointFederateList(byte[] buffer,
                        int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAsyncPointFederateList(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAdatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAsyncPointFederate.class;
   }
}
//end HLAsyncPointFederateList
```

```
// File: HLAsyncPointList.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;

/**
 * Type-safe MOM HLAsyncPointList variable array data type.
 * It uses <code>HLAunicodeString</code> elements.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAsyncPointList
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;

   /**
    * Constructs <code>this</code> of default value (empty array).
    */
   public
   HLAsyncPointList()
   {
      super();
   }

   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   HLAsyncPointList(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }
   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   HLAsyncPointList(Object o)
   {
      super(o);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointList(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointList(byte[] buffer,
                    int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }
   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAsyncPointList(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAdatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return HLAunicodeString.class;
   }
}
//end HLAsyncPointList
```

The HLAfixedrecorddatatype interface combines HLAdatatype with Java's Map. The HLAfixedRecordType abstract class extends Java's AbstractMap.

```
// File: HLAfixedrecorddatatype.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import java.util.Iterator;

/**
 * Interface implemented by the various HLA fixed record data types.
 * <p>
 * In addition to this interface, the HLA fixed record data type
classes are expected to supply:
 * <ul>
 * <li> Constructors (default and specified-value)</li>
 * <li> Constructor (byte[] buffer) throws CouldNotDecode</li>
 * <li> Constructor (byte[] buffer, int offset) throws
CouldNotDecode</li>
 * <li> Constructor (ByteWrapper byteWrapper) throws
CouldNotDecode</li>
 * <li> java.lang.Object methods toString(); equals(Object
otherObject) and hashCode()</li>
 * <li> Class-specific extensions to get and set the value as a basic
java data type (int, boolean, etc.)</li>
 * </ul>
 * A fixed record is a finite unvarying sequence of fields (at the
class level).
 * Each fixed record field has a Name and a Class.
 * We'll need two Iterators over the fields (one for the names,
another for the classes), get/set methods
 * indexed by Name for each field.
 * The octetBoundary is static for fixed records, being equal to the
largest octetBoundary of the record's fields.
 * The encodedLength will obviously depend on the total encodedLengths
of the various fields
 * (some of which may be dynamic arrays, for example).
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public interface
HLAfixedrecorddatatype
   extends java.util.Map,
           java.io.Serializable,
           java.lang.Cloneable,
           HLAdatatype
{
   /**
    * Returns an Iterator over the record's fields (as HLAdatatypes).
    * @return an Iterator over the record's fields (as HLAdatatypes)
    */
   Iterator
   iterator();
   /**
    * Returns an Iterator over the record's fields' names (as
Strings).
    * @return an Iterator over the record's fields' names (as Strings)
    */
   Iterator
   nameIterator();
}
//end HLAfixedrecorddatatype
```

```
// File: HLAfixedRecordIterator.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import java.util.Iterator;
import java.util.NoSuchElementException;
import java.util.ArrayList;
import java.lang.reflect.Field;

/**
 * Iterator implementation for HLA fixed record types.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAfixedRecordIterator
   implements Iterator
{
   /**
    * The enumerators over which to iterate.
    */
   private Object
   enumerators[];

   /**
    * Index of enumerator to be returned by subsequent call to next().
    */
   private int
   cursor;

   /**
    * Constructs the <code>Iterator</code> from an instance reference.
    * If the <code>boolean asStrings</code> is false, the
<code>Iterator</code> will enumerate the <code>Object</code>s;
    * otherwise it will enumerate the field names as
<code>String</code>s.
    * Note that unlike HLAenumeratedIterator, the argument must be an
instance (instead of a Class reference)
    * because the actual field values must be enumerated.
    * <p>
    * Examples: <code>Iterator itr = new HLAfixedRecordIterator(this,
false);</code>
    * <code>Iterator nameItr = new HLAfixedRecordIterator(this,
true);</code>
    * <p>
    * @param theInstance the instance whose public fields are to be
enumerated
    * @param asStrings a boolean which is false if the enumeration
should supply Objects, true if it should supply the field names (as
Strings) instead
    * @throws ClassCastException if theInstance doesn't implement the
HLAfixedrecorddatatype interface (or an IllegalAccessException
occurred internally)
    */
   public
   HLAfixedRecordIterator(Object theInstance, boolean asStrings)
      throws ClassCastException
   {
      if (!HLAfixedrecorddatatype.class.isInstance(theInstance)) throw
new ClassCastException(theInstance.getClass().toString());
      cursor = 0;
      ArrayList al = new ArrayList();
      //Obtain the object's accessible public fields
      Field[] theFields = theInstance.getClass().getFields();
      for (int i = 0; i < theFields.length; i++)
      {
         //Skip fields which do not implement the HLAdatatype
interface
         //To simplify the constructor, the IllegalAccessException
that this may throw is wrapped in a ClassCastException
         try
         {
            if
(HLAdatatype.class.isInstance(theFields[i].get(theInstance)))
            {
               if (asStrings)
               {
                  al.add(theFields[i].getName());
               }
               else
               {
                  al.add(theFields[i].get(theInstance));
               }
            }
         } catch (IllegalAccessException e)
         {
            ClassCastException cce = new
ClassCastException(e.getMessage());
            throw (ClassCastException)cce.initCause(e);
         }
      }
      al.trimToSize();
      enumerators = al.toArray();
   }
   /**
    * Constructs the <code>Iterator</code> from an instance reference,
returning Map.Entry elements.
    * <p>
    * HLAnullFixedRecord.entrySet().iterator() uses this constructor.
    * @param theInstance the instance whose public fields are to be
enumerated
    * @throws ClassCastException if theInstance doesn't implement the
HLAfixedrecorddatatype interface (or an IllegalAccessException
occurred internally)
    */
   public
   HLAfixedRecordIterator(Object theInstance)
      throws ClassCastException
   {
      if (!HLAfixedrecorddatatype.class.isInstance(theInstance)) throw
new ClassCastException(theInstance.getClass().toString());
      cursor = 0;
      ArrayList al = new ArrayList();
      //Obtain the object's accessible public fields
      Field[] theFields = theInstance.getClass().getFields();
      for (int i = 0; i < theFields.length; i++)
      {
         //Skip fields which do not implement the HLAdatatype
interface
         //To simplify the constructor, the IllegalAccessException
that this may throw is wrapped in a ClassCastException
         try
         {
            if
(HLAdatatype.class.isInstance(theFields[i].get(theInstance)))
            {
               al.add(new
HLAfixedRecordIterator.HLAfixedRecordMapEntry(theFields[i].getName(),
(HLAfixedrecorddatatype)theInstance));
            }
         } catch (IllegalAccessException e)
         {
            ClassCastException cce = new
ClassCastException(e.getMessage());
            throw (ClassCastException) cce.initCause(e);
         }
      }
      al.trimToSize();
      enumerators = al.toArray();
   }
   //java.util.Map.Entry implementation

   /**
    * The Map record class.
    * We enforce the expected types in the constructor and use the
underlying Object as the backing Map.
    */
   static class
   HLAfixedRecordMapEntry
      implements java.util.Map.Entry
   {
      //The name of the field
      String
      key;

      //The instance whose field it is (note that the field value
isn't stored)
      HLAfixedrecorddatatype
      instance;

      /**
       * Constructs a new Map.Entry from the specified String key and
HLAfixedrecorddatatype instance.
       * @param key a String specifying the name of the instance's
field
       * @param instance an HLAfixedrecorddatatype interface whose
field is being mapped
       * @throws IllegalArgumentException if the key or instance is
<code>null</code>
       */
      public
      HLAfixedRecordMapEntry(String                 key,
                             HLAfixedrecorddatatype instance)
         throws IllegalArgumentException
      {
         if ((key == null) || (instance == null)) throw new
IllegalArgumentException();
         this.key      = key;
         this.instance = instance;
      }

      /**
       * Returns the key (a String field name) corresponding to this
entry.
       * @return the key corresponding to this entry
       */
      public Object
      getKey()
      {
         return (Object)key;
      }
      /**
       * Returns the value (an HLAfixedrecorddatatype instance)
corresponding to this entry.
       * We return the actual value stored in the backing Object.
       * Because Map.Entry does not allow this method to throw any
exceptions,
       * should one occur we return <code>null</code> instead.
       * @return the value corresponding to this entry (or
<code>null</code> if an exception occurred internally)
       */
      public Object
      getValue()
      {
         try
         {
            return instance.getClass().getField(key).get(instance);
         }
         catch (Exception e)
         {
            return null;
         }
      }
      /**
       * Replaces the value corresponding to this entry with the
specified value.
       * Writes through to the Map.
       * The behaviour of this call is undefined if the mapping has
already been removed from the map
       * (by the iterator's remove operation).
       * @param value an Object (HLAfixedrecorddatatype instance) to
store in this entry
       * @return the old value that was stored in this entry
       * @throws UnsupportedOperationException if the operation is not
supported by the backing Map
       * @throws ClassCastException if the class of the specified
value prevents it from being stored in the backing Map
       * @throws IllegalArgumentException if some aspect of this value
prevents it from being stored in the backing Map
       * @throws NullPointerException if the backing Map does not
permit null values and the specified value is null
       */
      public Object
      setValue(Object value)
      {
         //Likewise, here we set the actual value, not the stored
instance reference
         if (value == null) throw new NullPointerException();
         //We wrap the other exceptions in an IllegalArgumentException
         try
         {
            Object oldValue =
instance.getClass().getField(key).get(instance);
            instance.getClass().getField(key).set(instance, value);
            return oldValue;
         }
         catch (Exception e) //NoSuchFieldException,
IllegalAccessException
         {
            IllegalArgumentException iae = new
IllegalArgumentException(e.getMessage());
            throw (IllegalArgumentException)iae.initCause(e);
         }
      }
      /**
       * Returns true iff <code>this</code> and
<code>otherObject</code> represent the same object.
       * @param otherObject the <code>Object</code> to compare with
       * @return <code>true</code> iff supplied
<code>otherObject</code> is of the same type as <code>this</code> and
has the same value
       * @see Object#hashCode Object.hashCode()
       * @see java.util.Hashtable Hashtable
       */
      public boolean
      equals(Object o)
      {
         if (!(o instanceof java.util.Map.Entry)) return false;
         java.util.Map.Entry e = (java.util.Map.Entry)o;
         return key.equals(e.getKey()) &&
getValue().equals(e.getValue());
      }

      /**
       * Returns a hash code for <code>this</code>; two objects for
which <code>equals()</code> is <code>true</code> should yield the same
hash code.
       * @return an <code>int</code> hash code
       * @see Object#equals(java.lang.Object)
Object.equals(java.lang.Object)
       * @see java.util.Hashtable Hashtable
       */
      public int
      hashCode()
      {
         return key.hashCode() ^ getValue().hashCode(); //bitwise XOR
      }

      /**
       * Returns a <code>String</code> representation of
<code>this</code>.
       * @return a {@link java.lang.String} reflecting
<code>this</code> value
       */
      public String
      toString()
      {
         return key + "=" + getValue().toString();
      }
   }
   //Iterator implementation

   /**
    * Returns <code>true</code> if the iteration has more elements.
    * In other words, returns <code>true</code> if <code>next()</code>
would return an element rather than throwing an exception.
    * @return a boolean which is <code>true</code> if the iterator has
more elements
    */
   public boolean
   hasNext()
   {
      return cursor < enumerators.length;
   }

   /**
    * Returns the next element in the iteration.
    * @return the next element in the iteration
    * @throws NoSuchElementException if the iteration has no more
elements
    */
   public Object
   next()
   {
      if (hasNext()) return enumerators[cursor++];
      throw new NoSuchElementException();
   }

   /**
    * Removes from the underlying collection the last element returned
by the iterator (optional operation).
    * This method can be called only once per call to
<code>next()</code>.
    * The behaviour of an <code>Iterator</code> is unspecified if the
underlying collection is modified
    * while the iteration is in progress in any way other than by
calling this method.
    * @throws UnsupportedOperationException if this operation is not
supported by this Iterator
    * @throws IllegalStateException if <code>next()</code> has not yet
been called, or <code>remove()</code> has already been called since
the last call to <code>next()</code>.
    */
   public void
   remove()
   {
      throw new UnsupportedOperationException();
   }
}
//end HLAfixedRecordIterator
```

```
// File: HLAfixedRecordType.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Set;
import java.util.Iterator;
import java.util.AbstractSet;
import java.lang.reflect.Field;

/**
 * Abstract implementation of the HLA fixed record type.
 * User-defined HLA fixed record types can be quickly defined as
extensions of this class,
 * defining the public fields and the constructors --no other code
needed.
 * Note that this class is field-less.
 * <p>
 * The <code>Map</code> is specified as mapping String keys
(representing the field names) to their values
(<code>HLAdatatype</code> implementations).
 * The map <code>size()</code> will be unchanging, since the record
will always have the same fields in the same order.
 * Values may not be <code>null</code> since they all must be HLA data
types (i.e. all references will exist).
 * <p>
 * The <code>put</code> method behaves exactly as direct access; that
is to say,
 * <code>put("fieldName", someObject)</code> is equivalent to
<code>fieldName = someObject</code>.
 * The <code>remove</code> method throws an
<code>UnsupportedOperationException</code>.
 * <p>
 * The helper class <code>HLAfixedRecordIterator</code> is used to
generate the various <code>Iterator</code>s.
 * The <code>Map</code> interface recommends supplying a void
constructor and a <code>Map</code> constructor.
 * See below for constructor templates.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAfixedRecordType
   extends java.util.AbstractMap
   implements HLAfixedrecorddatatype
{
   //If at all possible, it is strongly recommended that the concrete
class declare this field:
// public static final int
// octetBoundary = <whatever>;

   //The fixed record's fields should be declared here, in order.
   //Only those accessible public fields which implement the
HLAdatatype interface will be considered.
   //This abstract class declares no such fields.
   /**
    * Constructs a <code>HLAfixedRecordType</code> of default values.
    */
// public
// HLAfixedRecordType()
//    throws CouldNotDecode
// {
//    try
//    {
//       initializeFields();
//    }
//    catch (InstantiationException e)
//    {
//       CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
//       throw (CouldNotDecode)cnd.initCause(e);
//    }
// }

   /**
    * Creates a <code>HLAfixedRecordType</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfixedRecordType</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
// public
// HLAfixedRecordType(byte[] buffer)
//    throws CouldNotDecode
// {
//    this(buffer, 0);
// }

   /**
    * Creates a <code>HLAfixedRecordType</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAfixedRecordType</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAfixedRecordType</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
// public
// HLAfixedRecordType(byte[] buffer,
//                    int    offset)
//    throws CouldNotDecode
// {
//    this(new ByteWrapper(buffer, offset));
// }
```

```
   /**
    * Creates a <code>HLAfixedRecordType</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAfixedRecordType</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
// public
// HLAfixedRecordType(ByteWrapper byteWrapper)
//    throws CouldNotDecode
// {
//    this();
//    decode(byteWrapper);
// }

   /**
    * Creates a <code>HLAfixedRecordType</code> from the provided
<code>Map</code>.
    * @param theMap the <code>Map</code> representation of the
<code>HLAfixedRecordType</code>
    * @throws CouldNotDecode if the <code>Map</code> could not be
decoded
    */
// public
// HLAfixedRecordType(java.util.Map theMap)
//    throws CouldNotDecode
// {
//    this();
      //Wrap all exceptions as CouldNotDecode
//    try { putAll(theMap); }
//    catch (Exception e)
//    {
//       CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
//       throw (CouldNotDecode)cnd.initCause(e);
//    }
// }
```

```
   /**
    * Calls the void constructor on each of the HLAdatatype fields.
    * @throws InstantiationException if the class to instantiate is
abstract or an interface (or some other problem occurs)
    */
   protected void
   initializeFields()
      throws InstantiationException
   {
      //Obtain the object's accessible public fields
      Field[] theFields = this.getClass().getFields();
      for (int i = 0; i < theFields.length; i++)
      {
         //We're looking for fields which implement the HLAdatatype
interface
         //  I first thought of scanning getInterfaces() for
HLAdatatype.class, but
         //  that method only returns the interfaces *immediately*
implemented by the
         // class --it does not fetch the inherited interfaces!
         if
(HLAdatatype.class.isAssignableFrom(theFields[i].getType()))
         {
            //To simplify exception handling, we'll wrap the
IllegalAccessException in an InstantiationException
            try
            {
               theFields[i].set(this,
theFields[i].getType().newInstance());
            }
            catch (IllegalAccessException e)
            {
               InstantiationException ie = new
InstantiationException(e.getMessage());
               throw (InstantiationException)ie.initCause(e);
            }
         }
      }
   }
   //Map implementation

   //Map implementation: Modification Operations

   /**
    * Associates the specified value with the specified key in this
map (optional operation).
    * If the map previously contained a mapping for this key, the old
value is replaced.
    * @param key the Object key with which the specified value is to
be associated
    * @param value the Object value to be associated with the
specified key
    * @return previous value associated with the specified key, or
    *         <tt>null</tt> if there was no mapping for the key.
    *         A <tt>null</tt> return can also indicate that the map
previously associated
    *         <tt>null</tt> with the specified key, if the
implementation supports <tt>null</tt> values.
    * @throws UnsupportedOperationException if the operation is not
supported by this map
    * @throws ClassCastException if the class of the specified key or
value prevents it from being stored in this map
    * @throws IllegalArgumentException if some aspect of this key or
value prevents it from being stored in this map
    * @throws NullPointerException if this map does not permit
<tt>null</tt> keys or values, and the specified key or value is
<tt>null</tt>
    */
   public Object
   put(Object key, Object value)
   {
      try //We'll wrap the other exceptions in
IllegalArgumentException
      {
         Object o = this.getClass().getField((String) key).get(this);
         this.getClass().getField((String) key).set(this, value);
         return o;
      }
      catch (Exception e) //NoSuchFieldException,
IllegalAccessException
      {
         IllegalArgumentException iae = new
IllegalArgumentException(e.getMessage());
         throw (IllegalArgumentException)iae.initCause(e);
      }
   }
   /**
    * Removes the mapping for this key from this map if present
(optional operation).
    * Since the underlying Iterator does not allow remove(), neither
does this implementation.
    * @param key the Object key whose mapping is to be removed from
the map
    * @return the previous value associated with the specified key, or
    *         <tt>null</tt> if there was no entry for the key.
    *         A <tt>null</tt> return can also indicate that the map
previously associated
    *         <tt>null</tt> with the specified key, if the
implementation supports <tt>null</tt> values.
    * @throws UnsupportedOperationException if the operation is not
supported by this map
    */
   public Object
   remove(Object key)
   {
      throw new UnsupportedOperationException();
   }

   //Map implementation: Views

   /**
    * This field is initialized to contain an instance of the Set the
first time it is requested.
    * The view is stateless, so there's no reason to create more than
one.
    */
   transient volatile Set entrySet = null;

   /**
    * Returns a Set view of the mappings contained in this map.
    * Each element in this set is a Map.Entry.
    * The set is backed by the map, so changes to the map are
reflected in the set, and vice-versa.
    * If the map is modified while an iteration over the set is in
progress, the results of the iteration are undefined.
    * The set supports element removal, which removes the
corresponding entry from the map, via the
    * <tt>Iterator.remove</tt>, <tt>Set.remove</tt>,
<tt>removeAll</tt>, <tt>retainAll</tt> and
    * <tt>clear</tt> operations.  It does not support the <tt>add</tt>
or <tt>addAll</tt> operations.
    * @return a Set view of the mappings contained in this map.
    */
   public Set
   entrySet()
   {
      if (entrySet == null)
      {
         //Most of the Set implementation is supplied by
AbstractCollection and AbstractSet.
         //By default add(Object) throws
UnsupportedOperationException, which is fine for our purpose.
```

```
         entrySet = new AbstractSet()
         {
            transient volatile boolean sizeKnown = false;
            transient volatile int size = 0;

            /**
             * Returns an Iterator over the elements in this Set.
             * The elements are returned in no particular order
             * unless this Set is an instance of some class that
provides such a guarantee.
             * @return an Iterator over the elements in this Set
             */
            public Iterator
            iterator()
            {
               //We're not allowed to throw anything here
               try
               {
                  return new
HLAfixedRecordIterator(HLAfixedRecordType.this);
               }
               catch (ClassCastException iae) { return null; }
            }

            //AbstractMap.size() defers to this method
            /**
             * Returns the number of elements in this Set (its
cardinality).
             * If this Set contains more than Integer.MAX_VALUE
elements, returns Integer.MAX_VALUE.
             * @return the number of elements in this Set
             */
            public int
            size()
            {
               //First time we're asked?
               if (!sizeKnown)
               {
                  Iterator i = iterator();
                  while (i.hasNext())
                  {
                     size++;
                     i.next();
                  }
                  sizeKnown = true;
               }
               return size;
            }
         }; //end of anonymous inner class
      }
      return entrySet;
   }
   //HLAfixedrecorddatatype implementation

   /**
    * Returns an Iterator over the record's fields (as HLAdatatypes).
    * @return an Iterator over the record's fields (as HLAdatatypes)
    */
   public Iterator
   iterator()
   {
      //We're not allowed to throw anything here
      try
      {
         return new HLAfixedRecordIterator(this, false);
      }
      catch (ClassCastException iae) { return null; }
   }

   /**
    * Returns an Iterator over the record's fields' names (as
Strings).
    * @return an Iterator over the record's fields' names (as Strings)
    */
   public Iterator
   nameIterator()
   {
      //We're not allowed to throw anything here
      try
      {
         return new HLAfixedRecordIterator(this, true);
      }
      catch (ClassCastException iae) { return null; }
   }

   //java.lang.Object methods

   //java.lang.Object.toString supplied by AbstractMap
   //equals, as supplied by AbstractMap, isn't quite satisfactory as
it does not ensure
   //the field sequences are the same, or that the other object
descends from this class
   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      //This form is more inheritable, and will ensure that
otherObject is an instance of this' class
      if (! this.getClass().equals(otherObject.getClass())) return
false;
      //Iterate over the fields; they should be in lock-step
      Iterator itr = iterator();
      Iterator itrOther =
((HLAfixedRecordType)otherObject).iterator();
      while (itr.hasNext() && itrOther.hasNext())
      {
         if (!itr.next().equals(itrOther.next())) return false;
      }
      return !(itr.hasNext() || itrOther.hasNext());
   }

   //java.lang.Object.hashCode is supplied by AbstractMap

   //HLAdatatype interface implementation

   //Several of these methods are repeats from HLAbasicType (because
we can't inherit from both it and AbstractMap)
```

```
   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      HLAdatatype field;
      int theLength = 0;
      //Iterate over the fields
      Iterator itr = iterator();
      while (itr.hasNext())
      {
         field = (HLAdatatype)itr.next();
         while ((theLength % field.octetBoundary()) != 0) theLength++;
         theLength += field.encodedLength();
      }
      return theLength;
   }

   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      Object o = getThisField("octetBoundary");
      if (o != null) return ((Integer)o).intValue();

      int fieldBoundary;
      int theBoundary = 1;
      //Iterate over the fields
      Iterator itr = iterator();
      while (itr.hasNext())
      {
         fieldBoundary = ((HLAdatatype)itr.next()).octetBoundary();
         if (fieldBoundary > theBoundary) theBoundary = fieldBoundary;
      }
      return theBoundary;
   }
   /**
    * Encodes <code>this</code> into the <code>byte[]</code> at the
specified <code>offset</code>.
    * @param buffer the <code>byte[]</code> into which to encode
<code>this</code>
    * @param offset the offset into the <code>byte[]</code> at which
to encode <code>this</code>
    * @return how many bytes were written to the buffer, including any
prefix padding bytes
    */
   public int
   encode(byte[] buffer,
          int    offset)
   {
      return encode(new ByteWrapper(buffer, offset)).pos() - offset;
   }

   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      //Iterate over the fields
      Iterator itr = iterator();
      while (itr.hasNext())
((HLAdatatype)itr.next()).encode(byteWrapper);
      return byteWrapper;
   }

   /**
    * Encodes <code>this</code> into a new <code>byte[]</code>.
    * @return a <code>byte[]</code> encoding <code>this</code>
    */
   public byte[]
   toByteArray()
   {
      return encode(new ByteWrapper(encodedLength())).array();
   }
   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @return how many bytes were read from the <code>byte[]</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer)
      throws CouldNotDecode
   {
      return decode(buffer, 0);
   }

   /**
    * Sets <code>this</code> value from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> <code>this</code>
representation begins
    * @return where in the <code>buffer</code> <code>this</code>
representation ends
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public int
   decode(byte[] buffer,
          int    offset)
      throws CouldNotDecode
   {
      try
      {
         return decode(new ByteWrapper(buffer, offset)).pos();
      }
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      byteWrapper.align(octetBoundary());
      //Iterate over the fields
      Iterator itr = iterator();
      while (itr.hasNext())
((HLAdatatype)itr.next()).decode(byteWrapper);
      return byteWrapper;
   }

   //Cloneable implementation

   /**
    * Creates and returns an independent copy of this object.
    * @return an independent copy of this Object
    * @throws CloneNotSupportedException if the object's class is not
Cloneable or if the instance cannot be cloned
    */
   public Object
   clone()
      throws CloneNotSupportedException
   {
      //The method inherited from AbstractMap does a shallow copy;
      //the fields will have been copied too, so the clone's fields
      //will hold references to the same objects as the original.

      try
      {
//         return new HLAfixedRecordType(toByteArray());
         return this.getClass().getConstructor(new Class[] {
byte[].class } ).newInstance(new Object[] { this.toByteArray() } );
      }
      //Something is seriously wrong with the class if it can't encode
and then decode itself...
      catch (Exception e) //CouldNotDecode
      {
         CloneNotSupportedException cnse = new
CloneNotSupportedException(e.getMessage());
         throw (CloneNotSupportedException)cnse.initCause(e);
      }
   }
   //Supporting classes and methods

   /**
    * Returns the specified (static) field's value as an Object.
    * This is just an instance-proxy for the various class fields.
    * @param fieldName a String specifying the field's name
    * @return the requested field, as an Object (null in case of
failure)
    */
   private Object
   getThisField(String fieldName)
   {
      try
      {
         return this.getClass().getField(fieldName).get(null);
      }
      catch (Exception e) //NoSuchFieldException,
IllegalAccessException
      {
         return null;
      }
   }
}
//end HLAfixedRecordType
```

The MOM's fixed record types (`HLAinteractionCount`, `HLAinteractionSubscription`, `HLAobjectClassBasedCount`, and `HLAsyncPointFederate`) serve as demonstrations of the `HLAfixedRecordType` design pattern.

```
// File: HLAinteractionCount.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe MOM HLAinteractionCount fixed record data type.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteractionCount
   extends HLAfixedRecordType
{
   /** First field of <code>HLAinteractionCount</code>: an HLAhandle.
*/
   public HLAhandle HLAinteractionClass;
   /** Second field of <code>HLAinteractionCount</code>: an HLAcount.
*/
   public HLAcount  HLAinteractionCount;

   /**
    * Constructs <code>this</code> with default values.
    * @throws CouldNotDecode if an {@link InstantiationException}
occurs
    */
   public
   HLAinteractionCount()
      throws CouldNotDecode
   {
      //super() not called because super-class is abstract
      try
      {
         initializeFields();
      }
      catch (InstantiationException e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionCount(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionCount(byte[] buffer,
                       int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteractionCount(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   /**
    * Constructs <code>this</code> from the provided <code>Map</code>.
    * @param theMap the <code>Map</code> representation of the
<code>this</code>
    * @throws CouldNotDecode if the <code>Map</code> could not be
decoded
    */
   public
   HLAinteractionCount(java.util.Map theMap)
      throws CouldNotDecode
   {
      this();
      try
      {
         putAll(theMap);
      }
      //Wrap all exceptions as CouldNotDecode
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
}
//end HLAinteractionCount
```

```
// File: HLAinteractionSubscription.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe MOM HLAinteractionSubscription fixed record type.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAinteractionSubscription
   extends HLAfixedRecordType
{
   /** First field. */
   public HLAhandle  HLAinteractionClass;
   /** Second field. */
   public HLAboolean HLAactive;

   /**
    * Constructs <code>this</code> of default values.
    * @throws CouldNotDecode if an {@link InstantiationException}
occurs
    */
   public
   HLAinteractionSubscription()
      throws CouldNotDecode
   {
      //super() not called because super-class is abstract
      try
      {
         initializeFields();
      }
      catch (InstantiationException e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionSubscription(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAinteractionSubscription(byte[] buffer,
                              int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAinteractionSubscription(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   /**
    * Constructs <code>this</code> from the provided <code>Map</code>.
    * @param theMap the <code>Map</code> representation of
<code>this</code>
    * @throws CouldNotDecode if the <code>Map</code> could not be
decoded
    */
   public
   HLAinteractionSubscription(java.util.Map theMap)
      throws CouldNotDecode
   {
      this();
      try
      {
         putAll(theMap);
      }
      //Wrap all exceptions as CouldNotDecode
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
}
//end HLAinteractionSubscription
```

```
// File: HLAobjectClassBasedCount.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe MOM HLAobjectClassBasedCount fixed record data type.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAobjectClassBasedCount
   extends HLAfixedRecordType
{
   /** First field. */
   public HLAhandle HLAinteractionClass;
   /** Second field. */
   public HLAcount  HLAinteractionCount;

   /**
    * Constructs <code>this</code> with default values.
    * @throws CouldNotDecode if an {@link InstantiationException}
occurs
    */
   public
   HLAobjectClassBasedCount()
      throws CouldNotDecode
   {
      //super() not called because super-class is abstract
      try
      {
         initializeFields();
      }
      catch (InstantiationException e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAobjectClassBasedCount(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAobjectClassBasedCount(byte[] buffer,
                            int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAobjectClassBasedCount(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   /**
    * Constructs <code>this</code> from the provided <code>Map</code>.
    * @param theMap the <code>Map</code> representation of the
<code>this</code>
    * @throws CouldNotDecode if the <code>Map</code> could not be
decoded
    */
   public
   HLAobjectClassBasedCount(java.util.Map theMap)
      throws CouldNotDecode
   {
      this();
      try
      {
         putAll(theMap);
      }
      //Wrap all exceptions as CouldNotDecode
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
}
//end HLAobjectClassBasedCount
```

```
// File: HLAsyncPointFederate.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * Type-safe MOM HLAsyncPointFederate fixed record data type.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAsyncPointFederate
   extends HLAfixedRecordType
{
   /** First field. */
   public HLAhandle          HLAfederate;
   /** Second field. */
   public HLAsyncPointStatus HLAfederateSyncStatus;

   /**
    * Constructs <code>this</code> with default values.
    * @throws CouldNotDecode if an {@link InstantiationException}
occurs
    */
   public
   HLAsyncPointFederate()
      throws CouldNotDecode
   {
      //super() not called because super-class is abstract
      try
      {
         initializeFields();
      }
      catch (InstantiationException e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointFederate(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Constructs <code>this</code> from the network representation in
the provided <code>byte[]</code> at the indicated <code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of <code>this</code>
    * @param offset where in the <code>buffer</code> the
representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAsyncPointFederate(byte[] buffer,
                        int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Constructs <code>this</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of <code>this</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAsyncPointFederate(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   /**
    * Constructs <code>this</code> from the provided <code>Map</code>.
    * @param theMap the <code>Map</code> representation of the
<code>this</code>
    * @throws CouldNotDecode if the <code>Map</code> could not be
decoded
    */
   public
   HLAsyncPointFederate(java.util.Map theMap)
      throws CouldNotDecode
   {
      this();
      try
      {
         putAll(theMap);
      }
      //Wrap all exceptions as CouldNotDecode
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
}
//end HLAsyncPointFederate
```

The HLAvariantrecorddatatype interface extends HLAdatatype. The HLAvariantRecordType abstract class extends HLAbasicType. Oddly, variant record and fixed record classes have relatively little in common.

```
// File: HLAvariantrecorddatatype.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Iterator;

/**
 * Interface implemented by the HLA variant record data types.
 * <p>
 * In addition to this interface, the HLA variant record data type
classes are expected to supply:
 * <ul>
 * <li> Constructors (default and specified-value)</li>
 * <li> Constructor (byte[] buffer) throws CouldNotDecode</li>
 * <li> Constructor (byte[] buffer, int offset) throws
CouldNotDecode</li>
 * <li> Constructor (ByteWrapper byteWrapper) throws
CouldNotDecode</li>
 * <li> java.lang.Object methods toString(); equals(Object
otherObject) and hashCode()</li>
 * <li> Class-specific extensions as necessary</li>
 * </ul>
 * A variant record consists of a discriminant field (an enumerated
type), to each value of which
 * corresponds a (possibly different or null) alternative field (any
type).
 * The octetBoundary of a variant records is the largest of the
octetBoundaries of the discriminant
 * and the various possible alternatives.
 * encodedLength will obviously depend on the encodedLengths of the
various fields, discriminants and alternatives.
 * <p>
 * The behaviour of the type isn't clearly defined by the
specification; my assumptions follow.
 * Unlike the fixed record type, the variant record type's
discriminant and alternative fields
 * will be protected and access will occur through get and set
methods.
 * Changing the discriminant value will clear the previous alternative
and generate a default alternative.
 * <p>
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
```

```
public interface
HLAvariantrecorddatatype
   extends HLAdatatype
{
   /**
    * Returns an Iterator over the discriminant values.
    * This will be the same as the discriminant's class' iterator().
    * @return the requested Iterator
    */
   Iterator
   discriminantIterator();

   /**
    * Returns an Iterator over the alternative names (as Strings) by
discriminant value.
    * This will be in lock-step with the discriminantIterator.
    * Null alternatives will have the zero-length String as name.
    * @return the requested Iterator
    */
   Iterator
   alternativeNamesIterator();

   /**
    * Returns an Iterator over the alternative Classes by discriminant
value.
    * This will be in lock-step with the discriminantIterator.
    * @return the requested Iterator
    */
   Iterator
   alternativeClassIterator();

   /**
    * Returns a copy (clone) of the variant record's discriminant (an
HLA enumerated type instance).
    * @return the requested discriminant
    * @see #setDiscriminant
    */
   HLAenumerateddatatype
   getDiscriminant();

   /**
    * Returns the variant record's discriminant's name (as a String).
    * @return the requested discriminant's name (as a String)
    */
   String
   getDiscriminantName();
   /**
    * Sets the discriminant's value.
    * @param newDiscriminant an HLAenumerateddatatype (whose class
must match the discriminant's) which will be copied to the
discriminant
    * @return a String specifying the resulting Alternative's name
(could be null)
    * @throws CouldNotDecode if something goes awry
    * @see #getDiscriminant
    */
   String
   setDiscriminant(HLAenumerateddatatype newDiscriminant)
      throws CouldNotDecode;

   /**
    * Returns true if an alternative exists for the variant record's
current discriminant value (false if null).
    * @return a boolean which is true if there is a current
alternative
    */
   boolean
   hasAlternative();

   /**
    * Returns a copy of the variant record's current alternative
(either null or some HLA data type instance).
    * @return the requested alternative
    * @see #setAlternative
    */
   HLAdatatype
   getAlternative();

   /**
    * Returns the Class of the variant record alternative associated
with the specified discriminant value.
    * @param otherDiscriminant an HLAenumerateddatatype specifying the
discriminant value to query the alternatives with
    * @return the requested Class (could be null)
    * @throws IllegalArgumentException if the discriminant is not of
the correct class
    */
   Class
   getAlternativeClass(HLAenumerateddatatype otherDiscriminant)
      throws IllegalArgumentException;

   /**
    * Returns the variant record's current alternative's name (as a
String).
    * @return the requested alternative's name (as a String)
    */
   String
   getAlternativeName();
   /**
    * Returns the name (as a String) of the variant record's
alternative associated with the specified discriminant value.
    * @param discriminant an HLAenumerateddatatype specifying the
discriminant value to query the alternatives with
    * @return the requested alternative's name (as a String)
    * @throws IllegalArgumentException if the discriminant is not of
the correct class
    */
   String
   getAlternativeName(HLAenumerateddatatype discriminant)
      throws IllegalArgumentException;

   /**
    * Sets the variant record's current alternative to the specified
value.
    * @param newAlternative an HLAdatatype (whose class must match the
current alternative's) whose value will be copied to the record's
alternative
    * @return the current alternative's previous HLAdatatype value
    * @throws CouldNotDecode if something goes awry
    * @see #getAlternative
    */
   HLAdatatype
   setAlternative(HLAdatatype newAlternative)
      throws CouldNotDecode;
}
//end HLAvariantrecorddatatype
```

```
// File: HLAvariantRecordType.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;
import java.util.Collection;
import java.util.Iterator;
import java.util.ArrayList;

/**
 * HLA variant record data type abstract base class.
 * All user-defined variant record data types should descend from this
class and need only specify constructors.
 * <p>
 * The discriminant and alternatives held by this class will never be
exposed to the outside;
 * any references passed in will have clones stored, and any instances
emanating from the class
 * will be clones of the stored instances.
 * <p>
 * See HLAdemoVariantRecord for an example of how to use this class
with variant record data types.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public abstract class
HLAvariantRecordType
   extends    HLAbasicType
   implements HLAvariantrecorddatatype
{
   //If at all possible, it is strongly recommended that the concrete
class declare this field:
// public static final int
// octetBoundary = <whatever>;

   //These fields are required of the concrete class:

   //The discriminant Class
// public static final Class
// discriminantClass = HLAboolean.class;

   //The discriminant name
// public static final String
// discriminantName = "bool";

   //The array of alternative classes
// public static final Class[]
// alternativeClass = { null, HLAunicodeString.class };

   //The array of alternative names
// public static final String[]
// alternativeName = { "NA", "theString" };

   //The remaining fields are for this class' consumption
```

```
/** The discriminant value. */
protected HLAenumerateddatatype
_discriminant;

/** The discriminant index (into its Iterator) */
protected int
_discriminantIndex;

/** The discriminant cardinality. */
protected int
_discriminantCardinality;

/** The current alternative. */
protected HLAdatatype
_alternative;
```

```
   /**
    * Initializes the <code>HLAvariantRecordType</code> from the class
parametres.
    * For the concrete class to function, initialize() *must* be
called by the void constructor.
    * <p>
    * The discriminant is created using its void constructor, and the
corresponding
    * alternative (if any) created likewise.
    * The arrays of alternative classes and names must have their
lengths equal to
    * the cardinality of the discriminant's class' Iterator.
    * Null alternatives must have null classes and be named "NA".
    * @throws CouldNotDecode if any of the requirements are not met or
something else goes wrong
    */
   public void
   initialize()
      throws CouldNotDecode
   {
      //Wrap all exceptions in CouldNotDecode
      try {
         _discriminantIndex = -1;
         _discriminant =
(HLAenumerateddatatype)discriminantClass().newInstance();

         //Using the discriminant's Iterator, find its cardinality
         //and identify the current discriminantIndex in passing
         Iterator itr = discriminantIterator();
         _discriminantCardinality = 0;
         while (itr.hasNext())
         {
            if (itr.next().equals(_discriminant)) _discriminantIndex =
_discriminantCardinality;
            _discriminantCardinality++;
         }
         //Badly behaved HLAenumerateddatatype will either return a
zero discriminantSize or fail to index itself
         if (_discriminantIndex < 0) throw new
IllegalArgumentException(discriminantClass().getName());
         //alternativeName and alternativeClass must have the same
cardinality as the discriminantClass
         if (_discriminantCardinality !=
((String[])getThisField("alternativeName")).length) throw new
IllegalArgumentException("alternativeName.length != " +
discriminantClass().getName() + " cardinality");
         if (_discriminantCardinality !=
((Class[])getThisField("alternativeClass")).length) throw new
IllegalArgumentException("alternativeClass.length != " +
discriminantClass().getName() + " cardinality");
```

```
         //Validate the alternatives
         for (int i = 0; i < _discriminantCardinality; i++)
         {
            if (alternativeClass(i) == null)
            {
               if (alternativeName(i).compareToIgnoreCase("NA") != 0)
throw new IllegalArgumentException("alternativeName[" + i + "] !=
\"NA\"");
            } else {
               if (alternativeName(i).equals("") ||
(alternativeName(i).compareToIgnoreCase("NA") == 0)) throw new
IllegalArgumentException("alternativeName[" + i + "] = \"" +
alternativeName(i) + "\"");
               if
(!HLAdatatype.class.isAssignableFrom(alternativeClass(i))) throw new
IllegalArgumentException(alternativeClass(i).getName() + " !=
HLAdatatype");
            }
         }
         if (hasAlternative()) _alternative =
(HLAdatatype)alternativeClass(_discriminantIndex).newInstance();
      } catch (Exception e) { //InstantiationException,
IllegalArgumentException
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   //HLAdatatype implementation

   /**
    * Returns the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>.
    * <p>
    * As a general rule, Variant Records [HLAvariantRecord], Dynamic
Arrays [HLAvariableArray], and any
    * Fixed Arrays [HLAfixedArray] or Fixed Records [HLAfixedRecord]
containing either of these first two
    * cannot have a constant encodedLength.
    * @return the length (in bytes) of the <code>byte[]</code>
representation of <code>this</code>
    */
   public final int
   encodedLength()
   {
      //Note that the null-alternative encodedLength may be different
from _discriminant.encodedLength()
      if (!hasAlternative()) return _discriminant.encodedLength();
      return octetBoundary() + _alternative.encodedLength();
   }
   /**
    * Returns the octet boundary of <code>this</code>.
    * The octet boundary value is defined as the smallest power of 2
which is greater than or equal to the size of the datatype in bytes.
    * For a constructed datatype, it is the maximum octet boundary
value of all components within it.
    * <p>
    * In all cases octetBoundary is constant.
    * For HLAvariantRecord, the octet boundary is determined as the
largest octet boundary of the
    * discriminant and all possible alternatives.
    * @return the octet boundary of <code>this</code>
    */
   public final int
   octetBoundary()
   {
      Object o = getThisField("octetBoundary");
      if (o != null) return ((Integer)o).intValue();
      Class alt;
      int altBoundary;
      int theBoundary = _discriminant.octetBoundary();
      //Iterate over the possible alternatives
      Iterator itr = alternativeClassIterator();
      while (itr.hasNext())
      {
         alt = (Class)itr.next();
         //We skip the case where one of the alternatives is self, to
avoid infinite recursion
         //Note that this isn't fool-proof, since we could have, for
example,
         //an alternative which is a dynamic array of this class...
         if ((alt != null) && (!alt.equals(this.getClass())))
         {
            altBoundary = 0;
            try
            {
               altBoundary =
alt.getField("octetBoundary").getInt(null);
            }
            catch (Exception e) //NoSuchFieldException,
IllegalAccessException
            {
               //Most likely the class does not have a static
octetBoundary field
               try
               {
                  altBoundary =
((HLAdatatype)alt.newInstance()).octetBoundary();
               }
               catch (Exception ee) //ClassCastException,
IllegalAccessException, InstantiationException,
ExceptionInInitializerError, SecurityException
               {
                  //Give up!
               }
            }
            if (altBoundary > theBoundary) theBoundary = altBoundary;
         }
      }
      return theBoundary;
   }
   /**
    * Encodes <code>this</code> into the <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> into which to
encode <code>this</code>
    * @return the <code>ByteWrapper</code>
    */
   public ByteWrapper
   encode(ByteWrapper byteWrapper)
   {
      byteWrapper.align(octetBoundary());
      _discriminant.encode(byteWrapper);
      if (hasAlternative()) _alternative.encode(byteWrapper);
      return byteWrapper;
   }

   /**
    * Sets <code>this</code> value from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the data type begins
    * @return the <code>ByteWrapper</code>
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public ByteWrapper
   decode(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      try
      {
         byteWrapper.align(octetBoundary());
         _discriminant.decode(byteWrapper);
         _discriminantIndex = getIndex(_discriminant);
         if (!hasAlternative()) return byteWrapper;
         _alternative =
(HLAdatatype)alternativeClass(_discriminantIndex).newInstance();
         _alternative.decode(byteWrapper);
         return byteWrapper;
      }
      catch (Exception e) //InstantiationException,
IllegalAccessException
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   //HLAvariantrecorddatatype implementation

   /**
    * Returns an Iterator over the discriminant values.
    * This will be the same as the discriminant's class' iterator().
    * @return the requested Iterator
    */
   public Iterator
   discriminantIterator()
   {
      return _discriminant.iterator();
   }

   /**
    * Returns an Iterator over the alternative names (as Strings) by
discriminant value.
    * This will be in lock-step with the discriminantIterator.
    * Null alternatives will have the zero-length String as name.
    * @return the requested Iterator
    */
   public Iterator
   alternativeNamesIterator()
   {
      immutableArrayList ial = new
immutableArrayList(_discriminantCardinality);
      for (int i = 0; i < _discriminantCardinality; i++)
ial.add(alternativeName(i));
      ial.trimToSize();
      return ial.iterator();
   }

   /**
    * Returns an Iterator over the alternative Classes by discriminant
value.
    * This will be in lock-step with the discriminantIterator.
    * @return the requested Iterator
    */
   public Iterator
   alternativeClassIterator()
   {
      //You know, it's really annoying that ArrayList doesn't have an
(Object[]) constructor...
      immutableArrayList ial = new
immutableArrayList(_discriminantCardinality);
      //No need to clone the Class objects as there are no methods
that could change their state
      for (int i = 0; i < _discriminantCardinality; i++)
ial.add(alternativeClass(i));
      ial.trimToSize();
      return ial.iterator();
   }
   /**
    * Returns a copy (clone) of the variant record's discriminant (an
HLA enumerated type instance).
    * @return the requested discriminant
    * @see #setDiscriminant
    */
   public HLAenumerateddatatype
   getDiscriminant()
   {
      try
      {
         return
(HLAenumerateddatatype)cloneThroughInterface(_discriminant);
      }
      catch (Exception e) //(InstantiationException), CouldNotDecode
      {
         return null;
      }
   }

   /**
    * Returns the variant record's discriminant's name (as a String).
    * @return the requested discriminant's name (as a String)
    */
   public String
   getDiscriminantName()
   {
      return (String)this.getThisField("discriminantName");
   }
   /**
    * Sets the discriminant's value.
    * @param newDiscriminant an HLAenumerateddatatype (whose class
must match the discriminant's) which will be copied to the
discriminant
    * @return a String specifying the resulting Alternative's name
(could be null)
    * @throws CouldNotDecode if something goes awry
    * @see #getDiscriminant
    */
   public String
   setDiscriminant(HLAenumerateddatatype newDiscriminant)
      throws CouldNotDecode
   {
      int oldIndex = _discriminantIndex;
      _discriminant.decode(newDiscriminant.toByteArray());
      _discriminantIndex = getIndex(_discriminant);
      if (_discriminantIndex == oldIndex) return getAlternativeName();
      _alternative = null;
      if (!hasAlternative()) return getAlternativeName();
      try
      {
         _alternative =
(HLAdatatype)alternativeClass(_discriminantIndex).newInstance();
      }
      catch (Exception e) //InstantiationException,
IllegalAccessException
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
      return getAlternativeName();
   }

   /**
    * Returns true if an alternative exists for the variant record's
current discriminant value (false if null).
    * @return a boolean which is true if there is a current
alternative
    */
   public boolean
   hasAlternative()
   {
      return (null != alternativeClass(_discriminantIndex));
   }
   /**
    * Returns a copy (clone) of the variant record's current
alternative (either null or some HLA data type instance).
    * @return the requested alternative
    * @see #setAlternative
    */
   public HLAdatatype
   getAlternative()
   {
      if (!hasAlternative()) return null;
      try
      {
         return cloneThroughInterface(_alternative);
      }
      catch (Exception e) //(InstantiationException), CouldNotDecode
      {
         return null;
      }
   }

   /**
    * Returns the Class of the variant record alternative associated
with the specified discriminant value.
    * @param otherDiscriminant an HLAenumerateddatatype specifying the
discriminant value to query the alternatives with
    * @return the requested Class (could be null)
    * @throws IllegalArgumentException if the discriminant is not of
the correct class
    */
   public Class
   getAlternativeClass(HLAenumerateddatatype otherDiscriminant)
      throws IllegalArgumentException
   {
      if (!discriminantClass().equals(otherDiscriminant.getClass()))
throw new IllegalArgumentException();
      int index = getIndex(otherDiscriminant);
      if (index < 0) throw new IllegalArgumentException();
      return alternativeClass(index);
   }

   /**
    * Returns the variant record's current alternative's name (as a
String).
    * @return the requested alternative's name (as a String)
    */
   public String
   getAlternativeName()
   {
      return alternativeName(_discriminantIndex);
   }
   /**
    * Returns the name (as a String) of the variant record's
alternative associated with the specified discriminant value.
    * @param otherDiscriminant an HLAenumerateddatatype specifying the
discriminant value to query the alternatives with
    * @return the requested alternative's name (as a String)
    * @throws IllegalArgumentException if the discriminant is not of
the correct class
    */
   public String
   getAlternativeName(HLAenumerateddatatype otherDiscriminant)
      throws IllegalArgumentException
   {
      if (!discriminantClass().equals(otherDiscriminant.getClass()))
throw new IllegalArgumentException();
      int index = getIndex(otherDiscriminant);
      if (index < 0) throw new IllegalArgumentException();
      return alternativeName(index);
   }

   /**
    * Sets the variant record's current alternative to the specified
value.
    * @param newAlternative an HLAdatatype (whose class must match the
current alternative's) whose value will be copied to the record's
alternative
    * @return the current alternative's previous HLAdatatype value
    * @throws CouldNotDecode if something goes awry
    * @see #getAlternative
    */
   public HLAdatatype
   setAlternative(HLAdatatype newAlternative)
      throws CouldNotDecode
   {
      //Setting null to null is the trivial operation
      if ((newAlternative == null) && (_alternative == null)) return
null;
      //Switching from null to non-null or vice-versa is not allowed
      if ((newAlternative == null) || (_alternative == null)) throw
new CouldNotDecode("NullPointerException");
      //Classes must otherwise match
      if
(!alternativeClass(_discriminantIndex).equals(newAlternative.getClass(
))) throw new CouldNotDecode(newAlternative.getClass().getName());

      //Prepare the clone that will be returned
      HLAdatatype r = cloneThroughInterface(_alternative);
      //Update the stored instance's value
      _alternative.decode(newAlternative.toByteArray());
      return r;
   }
   //java.lang.Object methods

   /**
    * Returns a String representation of this.
    * The String representation consists of fixed-record-like list of
key-value mappings
    * (listing the discriminant and then the alternative) enclosed in
braces
    * (<tt>"{}"</tt>) and separated by the characters <tt>", "</tt>
(comma and space).
    * Each key-value mapping is rendered as the key followed by an
equals sign (<tt>"="</tt>) followed by the associated value.
    * Keys and values are converted to strings as by
<tt>String.valueOf(Object)</tt>.
    * In the special case of null alternatives, the key is represented
by "NA" and the value rendered as "null".
    * <p>
    * @return a String representation of this
    */
   public String
   toString()
   {
      StringBuffer buf = new StringBuffer();
      buf.append("{" + getDiscriminantName() + "=" +
_discriminant.toString() + ", ");
      buf.append(getAlternativeName() + "=");
      buf.append(hasAlternative() ? _alternative.toString() : "null");
      buf.append("}");
      return buf.toString();
   }
   /**
    * Returns true iff <code>this</code> and <code>otherObject</code>
represent the same object.
    * @param otherObject the <code>Object</code> to compare with
    * @return <code>true</code> iff supplied <code>otherObject</code>
is of the same type as <code>this</code> and has the same value
    * @see Object#hashCode Object.hashCode()
    * @see java.util.Hashtable Hashtable
    */
   public boolean
   equals(Object otherObject)
   {
      if (this == otherObject) return true;
      //This form is more inheritable, and will ensure that
otherObject is an instance of this' class (or a sub-class)

      //We disallow subclassing
      if (! this.getClass().equals(otherObject.getClass())) return
false;
//    if (! this.getClass().isInstance(otherObject)) return false;
      if
(!_discriminant.equals(((HLAvariantrecorddatatype)otherObject).getDisc
riminant())) return false;
      //Compare alternatives now
      HLAdatatype otherField =
((HLAvariantrecorddatatype)otherObject).getAlternative();
      if ((_alternative == null) && (otherField == null)) return true;
      if ((_alternative == null) || (otherField == null)) return
false;
      return _alternative.equals(otherField);
   }

   /**
    * Returns the hash code value for this.
    * @return the hash code value for this
    * @see java.util.Map.Entry#hashCode()
    * @see Object#hashCode()
    * @see Object#equals(Object)
    */
   public int
   hashCode()
   {
      int h = _discriminant.hashCode();
      return (hasAlternative() ? h + _alternative.hashCode() : h);
    }
   //Cloneable implementation

   /**
    * Creates and returns an independent copy of this object.
    * @return an independent copy of this Object
    * @throws CloneNotSupportedException if the object's class is not
Cloneable or if the instance cannot be cloned
    */
   public Object
   clone()
      throws CloneNotSupportedException
   {
      //The method inherited from Object does a shallow copy;
      //the fields will have been copied too, so the clone's fields
      //will hold references to the same objects as the original.

      try
      {
//         return new HLAvariantRecordType(toByteArray()); //This class
doesn't have this constructor
//         return new HLAvariantRecordType(_discriminant,
_discriminantName, _alternatives, _alternativeNames);
         return cloneThroughInterface(this);
      }
      //Something is seriously wrong with the class if it can't encode
and then decode itself...
      catch (Exception e) //CouldNotDecode
      {
         CloneNotSupportedException cnse = new
CloneNotSupportedException(e.getMessage());
         throw (CloneNotSupportedException)cnse.initCause(e);
      }
   }

   //Supporting classes and methods

   /**
    * Returns the specified (static) field's value as an Object.
    * This is just an instance-proxy for the various class fields.
    * @param fieldName a String specifying the field's name
    * @return the requested field, as an Object (null in case of
failure)
    */
   private Object
   getThisField(String fieldName)
   {
      try
      {
         return this.getClass().getField(fieldName).get(null);
      }
      catch (Exception e) //NoSuchFieldException,
IllegalAccessException
      {
         return null;
      }
   }
   /**
    * Returns the discriminant Class.
    * This is just an instance-proxy for the class field.
    * @return the discriminant Class
    */
   private Class
   discriminantClass()
   {
      return (Class)getThisField("discriminantClass");
   }

   /**
    * Returns the alternative name at the specified position within
the array.
    * This is just an instance-proxy for the class field, with
indexing.
    * @param index an int specifying the position to look up within
the array
    * @return the alternative name requested
    */
   private String
   alternativeName(int index)
   {
      return ((String[])getThisField("alternativeName"))[index];
   }

   /**
    * Returns the alternative Class at the specified position within
the array.
    * This is just an instance-proxy for the class field, with
indexing.
    * @param index an int specifying the position to look up within
the array
    * @return the requested Class
    */
   private Class
   alternativeClass(int index)
   {
      return ((Class[])getThisField("alternativeClass"))[index];
   }
   //Clone an HLAdatatype object through its byte[] constructor.
   private HLAdatatype
   cloneThroughInterface(HLAdatatype source)
      throws CouldNotDecode
   {
      if (source == null) return null;
      try
      {
         //In plain English, we fetch the object's byte[] constructor
and invoke it on the object's toByteArray() encoding
         return (HLAdatatype)source.getClass().getConstructor(new
Class[] { byte[].class } ).newInstance(new Object[] {
source.toByteArray() } );
         //Equivalently:
//       HLAdatatype theClone =
(HLAdatatype)source.getClass().newInstance();
//       theClone.decode(source.toByteArray());
//       return theClone;
      }
      catch (Exception e) //NoSuchMethodException,
InstantiationException
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }

   //Compute the index of the specified discriminant value into the
discriminant's Iterator.
   private int
   getIndex(HLAenumerateddatatype theDiscriminant)
   {
      int index = -1;
      Iterator itr = discriminantIterator();
      while (itr.hasNext())
      {
         index++;
         if (itr.next().equals(theDiscriminant)) return index;
      }
      return -1;
   }

   //An ArrayList that denies the iterator's remove() and its kin
   private class
   immutableArrayList
      extends ArrayList
   {
      immutableArrayList()
      {
         super();
      }

      immutableArrayList(Collection c)
      {
         super(c);
      }
      immutableArrayList(int initialCapacity)
      {
         super(initialCapacity);
      }

      public Object
      remove(int index)
      {
         throw new UnsupportedOperationException();
      }

      //ArrayList's implementation does not rely on its remove(), so
we must override this method too
      public void
      clear()
      {
         throw new UnsupportedOperationException();
      }

      //These we do not need to override; they are inherited from
AbstractCollection and rely on remove(int)
//    public boolean
//    remove(Object o)
//    public boolean
//    removeAll(Collection c)
//    public boolean
//    retainAll(Collection c)
   }
}
//end HLAvariantRecordType
```

Since the MOM does not provide any variant record examples, we illustrate our design pattern through the `HLAdemoVariantRecord` demonstration class.

```
// File: HLAdemoVariantRecord.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import hla.rti1516.CouldNotDecode;

/**
 * HLA demo variant record data type.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.1
 */
public class
HLAdemoVariantRecord
   extends HLAvariantRecordType
{
   /** The discriminant Class. */
   public static final Class
   discriminantClass = HLAboolean.class;

   /** The discriminant name. */
   public static final String
   discriminantName = "bool";

   /** The array of alternative classes. */
   public static final Class[]
   alternativeClass = { null, HLAunicodeString.class };

   /** The array of alternative names. */
   public static final String[]
   alternativeName = { "NA", "theString" };

   /**
    * Constructs a default <code>HLAdemoVariantRecord</code>.
    * @throws CouldNotDecode if initialization fails
    */
   public
   HLAdemoVariantRecord()
      throws CouldNotDecode
   {
      //super() not called because super-class is abstract
      initialize();
   }
   /**
    * Constructs a <code>HLAdemoVariantRecord</code> from another one.
    * @param other the HLAdemoVariantRecord instance to copy
    * @throws CouldNotDecode if initialization fails
    */
   public
   HLAdemoVariantRecord(HLAdemoVariantRecord other)
      throws CouldNotDecode
   {
      this();
      setDiscriminant(other.getDiscriminant());
      setAlternative(other.getAlternative());
   }

   //The remaining constructors are boiler-plate

   /**
    * Creates a <code>HLAdemoVariantRecord</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAdemoVariantRecord</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAdemoVariantRecord(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>HLAdemoVariantRecord</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>HLAdemoVariantRecord</code>
    * @param offset where in the <code>buffer</code> the
<code>HLAdemoVariantRecord</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   HLAdemoVariantRecord(byte[] buffer,
                        int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>HLAdemoVariantRecord</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>HLAdemoVariantRecord</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   HLAdemoVariantRecord(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
}
//end HLAdemoVariantRecord
```

The `Normalization` class implements a number of normalization and unnormalization methods statically.

```
// File: Normalization.java
package ca.gc.drdc_rddc.hla.rti1516.omt;

import java.math.BigInteger;
import hla.rti1516.*;

/**
 * Utility class for normalizing values over dimensions.
 * This first draft uses only static methods, but that is clearly
inefficient.
 * I think we should have a Normalization constructor that expects two
parametres:
 * the RTIambassador instance and the DimensionHandle (or,
equivalently, the dimension's name).
 * This would allow the Normalization instance to cache the
dimension's upper bound at the outset,
 * and all further methods would be slaved to that specific dimension.
 * This pattern could be further extended by passing the domain's
bounds to the constructor as well.
 * In that latter case, not all members would be accessible (an
enumerated set domain, for example,
 * would not allow the other normalization methods).
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.2
 */
```

```
public class
Normalization
{
   /**
    * Linear normalization function for integer values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param domainLower the lower bound on the possible values of
domain
    * @param domainUpper the upper bound on the possible values of
domain
    * @param domain a nonenumerated integer value known to the
federate using the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   linear(RTIambassador   rti,
          DimensionHandle dimension,
          long            domainLower,
          long            domainUpper,
          long            domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       [(domain - domainLower) / (domainUpper - domainLower)] * (DUB
- 1)
//       or more accurately
//       [(domain - domainLower) * (DUB - 1) ] / (domainUpper -
domainLower)
         BigInteger dub = new
BigInteger(Long.toString(rti.getDimensionUpperBound(dimension) - 1));
         BigInteger l = new BigInteger(Long.toString(domainLower));
         BigInteger u = new BigInteger(Long.toString(domainUpper));
         BigInteger d = new BigInteger(Long.toString(domain));
//       return
(((d.subtract(l)).multiply(dub)).divide(u.subtract(l))).longValue();
         return
d.subtract(l).multiply(dub).divide(u.subtract(l)).longValue();
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Linear unnormalization function.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param domainLower the lower bound on the possible values of
domain
    * @param domainUpper the upper bound on the possible values of
domain
    * @return a nonenumerated integer value known to the federate
using the dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   unlinear(RTIambassador   rti,
            DimensionHandle dimension,
            long            normalized,
            long            domainLower,
            long            domainUpper)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       domainLower + ceiling([normalized * (domainUpper -
domainLower)] / (DUB - 1))
         BigInteger dub = new
BigInteger(Long.toString(rti.getDimensionUpperBound(dimension) - 1));
         BigInteger n = new BigInteger(Long.toString(normalized));
         BigInteger l = new BigInteger(Long.toString(domainLower));
         BigInteger u = new BigInteger(Long.toString(domainUpper));
         return l.add(ceiling(n.multiply(u.subtract(l)),
dub)).longValue();
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Linear normalization function for floating-point values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param domainLower the lower bound on the possible values of
domain
    * @param domainUpper the upper bound on the possible values of
domain
    * @param domain a floating-point value known to the federate using
the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   linear(RTIambassador   rti,
          DimensionHandle dimension,
          double          domainLower,
          double          domainUpper,
          double          domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       [(domain - domainLower) / (domainUpper - domainLower)] * (DUB
- 1)
         //Converting between double and long is sure a pain in the
behind, because of the "possible loss of precision" compiler error...
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         return new Double(dub*(domain - domainLower)/(domainUpper -
domainLower)).longValue();
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Linear unnormalization function for floating-point values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param domainLower the floating-point lower bound on the
possible values of domain
    * @param domainUpper the floating-point upper bound on the
possible values of domain
    * @return a floating-point value known to the federate using the
dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static double
   unlinear(RTIambassador   rti,
            DimensionHandle dimension,
            long            normalized,
            double          domainLower,
            double          domainUpper)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       domainLower + ceiling([normalized * (domainUpper -
domainLower)] / (DUB - 1))
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         double n =
Double.valueOf(Long.toString(normalized)).doubleValue();
         //Converting between double and long is sure a pain in the
behind, because of the "possible loss of precision" compiler error...
         return domainLower + n*(domainUpper-domainLower)/dub;
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Linear enumerated normalization function.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param domain an enumerated data type value known to the
federate using the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   linearEnumerated(RTIambassador         rti,
                    DimensionHandle       dimension,
                    HLAenumerateddatatype domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       [positionInMappedSet(domain) /(mappedSetLength - 1)] * (DUB -
1)
         long pos = -1;
         long lngth = 0; //This will count the cardinality of the
enumerated data type
         for (java.util.Iterator i = domain.iterator(); i.hasNext();
lngth++)
         {
            if (i.next().equals(domain)) pos = lngth;
         }
         BigInteger dub = new
BigInteger(Long.toString(rti.getDimensionUpperBound(dimension) - 1));
         BigInteger p = new BigInteger(Long.toString(pos));
         BigInteger l = new BigInteger(Long.toString(lngth-1));
         return ((p.multiply(dub)).divide(l)).longValue();
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Linear enumerated unnormalization function.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param domain an enumerated data type value known to the
federate using the dimension
    * @return an Object (an enumerated data type instance) known to
the federate using the dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static Object
   unlinearEnumerated(RTIambassador         rti,
                      DimensionHandle       dimension,
                      long                  normalized,
                      HLAenumerateddatatype domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       mappedSet[ normalized * (mappedSetLength - 1) / (DUB - 1) ]
         //Because HLAenumerateddatatype has no "length" or
"cardinality" member, we must loop twice!
         //Count the cardinality of the enumerated data type
         long lngth = 0;
         for (java.util.Iterator i = domain.iterator(); i.hasNext();
i.next()) { lngth++; }
         //Now that we know the enumerated type's cardinality, we can
decode the normalized value
         BigInteger dub = new
BigInteger(Long.toString(rti.getDimensionUpperBound(dimension) - 1));
         BigInteger n = new BigInteger(Long.toString(normalized));
         BigInteger l = new BigInteger(Long.toString(lngth-1));
         long pos = n.multiply(l).divide(dub).longValue();
         for (java.util.Iterator i = domain.iterator(); i.hasNext();
i.next())
         {
            if (pos == 0) return i.next();
            pos--;
         }
         return null;
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Enumerated set normalization function.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param theMap a Map whose entries have the domain values as keys
and the long values as values
    *                (or null to use the enumerated data type's
getValue method)
    * @param domain an enumerated data type value known to the
federate using the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   enumeratedSet(RTIambassador         rti,
                 DimensionHandle       dimension,
                 java.util.Map         theMap,
                 HLAenumerateddatatype domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
         if (theMap == null)
         {
            //An HLAenumerateddatatype normally descends from an
HLAbasictype or HLAbasictype
            //And should thus have a getValue() method (which can
return anything from a byte to a double or even a String)
            return unwrap(domain.getClass().getMethod("getValue",
(Class[])null).invoke(domain, (Object[])null));
         } else {
            return unwrap(theMap.get(domain));
         }
      } catch (Exception e) {
      //ClassCastException, NullPointerException,
NoSuchMethodException, SecurityException, IllegalAccessException,
IllegalArgumentException, java.lang.reflect.InvocationTargetException,
ExceptionInInitializerError
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Enumerated set unnormalization function.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param theMap a Map whose entries have the domain values as keys
and the long values as values
    *                (or null to use the enumerated data type's long
constructor)
    * @param domain an enumerated data type value known to the
federate using the dimension
    * @return an Object (an enumerated data type instance) known to
the federate using the dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static Object
   unenumeratedSet(RTIambassador         rti,
                   DimensionHandle       dimension,
                   long                  normalized,
                   java.util.Map         theMap,
                   HLAenumerateddatatype domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
         if (theMap == null)
         {
            //An HLAenumerateddatatype normally descends from an
HLAbasictype or HLAbasictype
            //And should thus have a setValue() method (which can take
anything as its argument, from a byte to a double or even a String)
            //Here we assume there is a (long) constructor
            //We should really get all Constructors() and scan its
getParameterTypes() in order of preference for long-compatible
forms...
            //Like we do with the unwrap method.
            return domain.getClass().getConstructor(new Class[]
{long.class}).newInstance(new Object[] {new Long(normalized)});
            //Oddly, the Object[] required by the newInstance does get
converted back to the primitives required by our chosen constructor...
         } else {
            for (java.util.Iterator i = theMap.entrySet().iterator();
i.hasNext(); )
            {
               java.util.Map.Entry me = (java.util.Map.Entry)i.next();
               if (unwrap(me.getValue()) == normalized) return
me.getKey();
            }
            return null;
         }
      } catch (Exception e) {
      //NoSuchMethodException, SecurityException,
InstantiationException, IllegalAccessException,
IllegalArgumentException, java.lang.reflect.InvocationTargetException
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Logarithmic normalization function for integer values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param domainLower the lower bound on the possible values of
domain
    * @param domainUpper the upper bound on the possible values of
domain
    * @param domain a nonenumerated integer value known to the
federate using the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   logarithmic(RTIambassador   rti,
               DimensionHandle dimension,
               long            domainLower,
               long            domainUpper,
               long            domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
         //Note that the result is independent of the logarithm's
base; here we use the natural logarithm
//       [log(domain/domainLower) / log(domainUpper/domainLower)] *
(DUB - 1)
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         return new
Double(dub*java.lang.Math.log(((double)domain)/(double)domainLower)/ja
va.lang.Math.log(((double)domainUpper)/(double)domainLower)).longValue
();
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Logarithmic unnormalization function for integer values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param domainLower the lower bound on the possible values of
domain
    * @param domainUpper the upper bound on the possible values of
domain
    * @return a long known to the federate using the dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   unlogarithmic(RTIambassador   rti,
                 DimensionHandle dimension,
                 long            normalized,
                 long            domainLower,
                 long            domainUpper)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
         //Note that the result is independent of the logarithm's
base; here we use the natural logarithm
//       domainLower * exp(log(du/dl)*normalized/(DUB - 1))
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         double n =
Double.valueOf(Long.toString(normalized)).doubleValue();
         double dl =
Double.valueOf(Long.toString(domainLower)).doubleValue();
         double du =
Double.valueOf(Long.toString(domainUpper)).doubleValue();
         return
ceiling(dl*java.lang.Math.exp(java.lang.Math.log(du/dl)*n/dub));
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Logarithmic normalization function for floating-point values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param domainLower the floating-point lower bound on the
possible values of domain
    * @param domainUpper the floating-point upper bound on the
possible values of domain
    * @param domain a floating-point value known to the federate using
the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   logarithmic(RTIambassador   rti,
               DimensionHandle dimension,
               double          domainLower,
               double          domainUpper,
               double          domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       [log(domain/domainLower) / log(domainUpper/domainLower)] *
(DUB - 1)
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         return new
Double(dub*java.lang.Math.log(domain/domainLower)/java.lang.Math.log(d
omainUpper/domainLower)).longValue();
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Logarithmic unnormalization function for floating-point values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param domainLower the floating-point lower bound on the
possible values of domain
    * @param domainUpper the floating-point upper bound on the
possible values of domain
    * @return a double known to the federate using the dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static double
   unlogarithmic(RTIambassador   rti,
                 DimensionHandle dimension,
                 long            normalized,
                 double          domainLower,
                 double          domainUpper)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
         //Note that the result is independent of the logarithm's
base; here we use the natural logarithm
//       domainLower * exp(log(du/dl)*normalized/(DUB - 1))
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         double n =
Double.valueOf(Long.toString(normalized)).doubleValue();
         return
domainLower*java.lang.Math.exp(java.lang.Math.log(domainUpper/domainLo
wer)*n/dub);
      } catch (NumberFormatException e) {
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Hyperbolic tangent normalization function for integer values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param domainCentre the value of domain around which the user
desires the greatest precision
    * @param domainSize a generic measure of the distance around the
domainCentre for which the user desires the relatively high precision
    * @param domain a non-enumerated integer value known to the
federate using the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   tanh(RTIambassador   rti,
        DimensionHandle dimension,
        long            domainCentre,
        long            domainSize,
        long            domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//         [{tanh([domain - domainCenter]/domainSize) + 1}/2] * (DUB -
1)
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         return new Double(dub*(tanh((((double)domain)-
(double)domainCentre)/(double)domainSize) + 1.0)/2.0).longValue();
      } catch (Exception e) { //NumberFormatException
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Hyperbolic tangent unnormalization function for integer values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param domainCentre the value of domain around which the user
desires the greatest precision
    * @param domainSize a generic measure of the distance around the
domainCentre for which the user desires the relatively high precision
    * @return a non-enumerated integer value known to the federate
using the dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   untanh(RTIambassador   rti,
          DimensionHandle dimension,
          long            normalized,
          long            domainCentre,
          long            domainSize)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       domainCentre + domainSize*atanh([2*normalized/(DUB - 1)] - 1)
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         double n =
Double.valueOf(Long.toString(normalized)).doubleValue();
         double dc =
Double.valueOf(Long.toString(domainCentre)).doubleValue();
         double ds =
Double.valueOf(Long.toString(domainSize)).doubleValue();
//       return new Double(dc + ds*atanh((2.0*n/dub) -
1.0)).longValue();
         return ceiling(dc + ds*atanh((2.0*n/dub) - 1.0));
      } catch (Exception e) { //NumberFormatException
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Hyperbolic tangent normalization function for floating-point
values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension unto
which to normalize the domain
    * @param domainCentre the floating-point value of domain around
which the user desires the greatest precision
    * @param domainSize a generic measure of the distance around the
domainCentre for which the user desires the relatively high precision
    * @param domain a floating-point value known to the federate using
the dimension
    * @return a long falling within the dimension's {@link
RangeBounds}
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static long
   tanh(RTIambassador   rti,
        DimensionHandle dimension,
        double          domainCentre,
        double          domainSize,
        double          domain)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       [{tanh([domain - domainCenter]/domainSize) + 1}/2] * (DUB -
1)
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         return new Double(dub*(tanh((domain-domainCentre)/domainSize)
+ 1.0)/2.0).longValue();
      } catch (Exception e) { //NumberFormatException
         throw new FederateInternalError(e.getMessage());
      }
   }
   /**
    * Hyperbolic tangent unnormalization function for floating-point
values.
    * @param rti the RTIambassador to use
    * @param dimension a DimensionHandle specifying the dimension
whence the normalized value comes
    * @param normalized a long falling within the dimension's {@link
RangeBounds}
    * @param domainCentre the floating-point value of the domain
around which the user desires the greatest precision
    * @param domainSize a generic measure of the distance around the
domainCentre for which the user desires the relatively high precision
    * @return a non-enumerated integer value known to the federate
using the dimension
    * @throws InvalidDimensionHandle if the {@link DimensionHandle} is
invalid
    * @throws FederateNotExecutionMember if the federate is not
currently joined to a federation execution
    * @throws RTIinternalError if something else goes wrong within an
RTIambassador call
    * @throws FederateInternalError if something goes wrong with the
rest of the method
    */
   public static double
   untanh(RTIambassador   rti,
          DimensionHandle dimension,
          long            normalized,
          double          domainCentre,
          double          domainSize)
      throws InvalidDimensionHandle,
             FederateNotExecutionMember,
             RTIinternalError,
             FederateInternalError
   {
      try
      {
//       domainCentre + domainSize*atanh([2*normalized/(DUB - 1)] - 1)
         double dub =
Double.valueOf(Long.toString(rti.getDimensionUpperBound(dimension) -
1)).doubleValue();
         double n =
Double.valueOf(Long.toString(normalized)).doubleValue();
         return domainCentre + domainSize*atanh((2.0*n/dub) - 1.0);
      } catch (Exception e) { //NumberFormatException
         throw new FederateInternalError(e.getMessage());
      }
   }
   //Support methods

   /**
    * Returns the ceiling of the integer division of the dividend by
the divisor.
    * The ceiling is defined as the smallest integer to be larger than
or equal to the real quotient.
    * Thus ceiling(3, 2) is 2 but ceiling(-3, 2) and ceiling(3, -2) is
-1
    * @param dividend a BigInteger dividend
    * @param divisor a BigInteger divisor
    * @return a BigInteger representing the ceiling of the quotient
    * @throws ArithmeticException if the divisor is BigInteger.ZERO
    */
   public static BigInteger
   ceiling(BigInteger dividend,
           BigInteger divisor)
   throws ArithmeticException
   {
      //In Java, division of a negative by a positive yields a
negative (or zero) remainder
//               division of a positive by a negative yields a
positive (or zero) remainder
      BigInteger[] ab = dividend.divideAndRemainder(divisor);
      if ((divisor.signum()*ab[1].signum()) > 0)
      { return ab[0].add(BigInteger.ONE); }
      else
      { return ab[0]; }
   }

   /**
    * Returns the floor of the integer division of the dividend by the
divisor.
    * The floor is defined as the largest integer to be smaller than
or equal to the real quotient.
    * Thus floor(3, 2) is 1 but floor(-3, 2) and floor(3, -2) is -2
    * @param dividend a BigInteger dividend
    * @param divisor a BigInteger divisor
    * @return a BigInteger representing the floor of the quotient
    * @throws ArithmeticException if the divisor is BigInteger.ZERO
    */
   public static BigInteger
   floor(BigInteger dividend,
         BigInteger divisor)
   throws ArithmeticException
   {
      //In Java, division of a negative by a positive yields a
negative (or zero) remainder
//               division of a positive by a negative yields a
positive (or zero) remainder
      BigInteger[] ab = dividend.divideAndRemainder(divisor);
      if ((divisor.signum()*ab[1].signum()) < 0)
      { return ab[0].subtract(BigInteger.ONE); }
      else
      { return ab[0]; }
   }
   /**
    * Returns the ceiling of the specified double as a long.
    * The ceiling is defined as the smallest integer to be larger than
or equal to the specified double.
    * Thus ceiling(1.5) is 2 but ceiling(-1.5) is -1
    * @param aDouble a double value to convert
    * @return a long representing the ceiling of the specified double
    * @throws ArithmeticException if the double is Double.NaN,
Double.NEGATIVE_INFINITY, Double.POSITIVE_INFINITY, or outside the
range Long.MIN_VALUE to Long.MAX_VALUE
    */
   public static long
   ceiling(double aDouble)
   throws ArithmeticException
   {
      if (Double.isNaN(aDouble) || Double.isInfinite(aDouble) ||
(aDouble > (double)Long.MAX_VALUE) || (aDouble <
(double)Long.MIN_VALUE))
         throw new ArithmeticException();
      Double d = new Double(aDouble);
      //d.longValue() truncates, so...
      //...We convert the resulting long back into a double:
//    Double dd = new Double(new Long(d.longValue()).toString());
      double dd = (double)d.longValue();
      //If the original double is larger, there is some remainder
      if (aDouble > dd)
      { return d.longValue()+1; }
      else
      { return d.longValue(); }
   }

   /**
    * Returns the hyperbolic tangent of the specified value.
    * Weirdly, this method isn't supplied by java.lang.Math.
    * <p>
    * tanh(z) = sinh(z)/cosh(z) = (exp(z)-exp(-z))/(exp(z)+exp(-z)) =
(exp(2*z)-1)/(exp(2*z)+1)
    * @param z a double specifying the value whose hyperbolic tangent
is desired
    * @return a double specifying the hyperbolic tangent of the
specified value
    */
   public static double
   tanh(double z)
   {
      double r = java.lang.Math.exp(z+z);
      return (r - 1.0)/(r + 1.0);
   }
   /**
    * Returns the hyperbolic arc-tangent of the specified value.
    * Weirdly, this method isn't supplied by java.lang.Math.
    * <p>
    * atanh(z) = 1/2 ln((1+z)/(1-z))
    * @param z a double specifying the value whose hyperbolic arc-
tangent is desired
    * @return a double specifying the hyperbolic arc-tangent of the
specified value
    */
   public static double
   atanh(double z)
   {
      return java.lang.Math.log((1+z)/(1-z))/2.0;
   }

   /**
    * Unwraps the primitive contained in the specified Object.
    * @param o an Object which should be a wrapper around a primitive
type
    * @return a long representing the primitive wrapped by the
specified Object
    * @throws ClassCastException if the Object does not wrap a
primitive type (or it wraps the Void.TYPE)
    */
   public static long
   unwrap(Object o)
      throws ClassCastException
   {
      //Must unwrap the primitive
      Class c = o.getClass();
      if      (c.equals(Boolean.TYPE))
      { return (((Boolean)o  ).booleanValue() ? 1 : 0); }
      else if (c.equals(Character.TYPE))
      { return ( (Character)o).charValue(); }
      else if (c.equals(Byte.TYPE))
      { return ( (Byte)o     ).longValue(); }
      else if (c.equals(Short.TYPE))
      { return ( (Short)o    ).longValue(); }
      else if (c.equals(Integer.TYPE))
      { return ( (Integer)o  ).longValue(); }
      else if (c.equals(Long.TYPE))
      { return ( (Long)o     ).longValue(); }
      else if (c.equals(Float.TYPE))
      { return ( (Float)o    ).longValue(); }
      else if (c.equals(Double.TYPE))
      { return ( (Double)o   ).longValue(); }
      else //includes Void.TYPE and all non-primitive others
      { throw new ClassCastException(); }
   }
}
//end Normalization
```

Annex D - DRDC HLA 1516 FederateAmbassador Supporting Classes

The ca.gc.drdc_rddc.hla.rti1516.FedAmb package consist of three sets of classes. The first (Validate…) defines callback validation interfaces, allowing callback handling to be broken down into a validation step followed by the event handling proper. The second (FederateAmbassador… and FedAmb…) breaks up the FederateAmbassador interface so that it can be implemented piecemeal. In particular, this allows the federate to dynamically change parts of its implementation during execution, by allocating responsibility to distinct event handlers.

The third, NativeFederateAmbassador, which is not included here because it is somewhat out of the scope of this work, is a utility class designed to facilitate the implementation of FederateAmbassador as a native class. That is to say, it allows other languages than Java to integrate themselves into a Java-mediated HLA federation by supplying a library (a Windows DLL or a Unix SO). The “foreign” application is expected to access the RTIambassador through the Java Native Interface (JNI), using the NativeFederateAmbassador class to hook its library in. This library is invoked by the federate service thread during FederateAmbassador callbacks; after doing validation as required, the library then hands off any remaining processing to another thread, just like in Java. Under Windows, this hand-off can be achieved through messaging. A Delphi 7 prototype demonstrator is available upon request.

In implementing the FederateAmbassador interface, keeping all of the code in a single class is extremely unwieldy. In any case, because of the ConcurrentAccess limitation, the amount of actual work done by the class invoked within the federate service thread by the RTI is perforce quite limited. For a given callback, the only processing that must occur immediately is the callback validation, because the RTI expects various exceptions to be thrown by the federate ambassador if things appear awry to the federate. Once that validation is done, any lengthy work is best threaded off to another part of the federate, and such hand-off becomes imperative if RTIambassador calls are to be made as part of the event handling.

A frequent design pattern in graphical user-interfaces (GUI) applications is to have handlers attached to events. Typically, an event corresponds to a user action, such as button click, but events can also correspond to internal state changes or operating system messages. Elements of the GUI can be re-used when the context changes, simply by changing some of their aspect (e.g. a caption changes from “Log On” to “Log Off”) and re-assigning one or more event handlers. This avoids having a single larger handler begin with inefficient and repetitive context detection code (if such and such flags are set, etc.), and simplifies code maintenance.

In similar fashion, the `FederateAmbassador` interface can be broken down into sub-interfaces (`FederateAmbassador`…), each one regrouping callbacks relevant to a distinct aspect of the HLA. The sub-interface set is complete, in the sense that the `FederateAmbassador` interface is the union of all the sub-interfaces (every `FederateAmbassador` callback occurs in exactly one of the sub-interfaces, and every `FederateAmbassador`… callback occurs in the `FederateAmbassador` interface).

We provide a null-like implementation for each such sub-interface, allowing the designer to override just those few callbacks of interest to him. To facilitate the design further, callbacks that occur in varying forms are “rolled-up” by these implementations into the most complete form, substituting nulls where appropriate.

There is one `Validate…` interface for each of the `FederateAmbassador` callbacks. Each interface has but one method, `validate`, which expects the same arguments as the callback and throws the same exceptions. When the callback is overloaded (`InitiateFederateSave, ReceiveInteraction, ReflectAttributeValues,` and `RemoveObjectInstance`), so is the `validate` method.

```
// File: ValidateAnnounceSynchronizationPoint.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateAnnounceSynchronizationPoint
{
   /**
    * Validates the announceSynchronizationPoint callback arguments.
    * @param synchronizationPointLabel a String giving the
synchronization point's identifier
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#announceSynchronizationPoint
    */
   public void
   validate(
      String synchronizationPointLabel,
      byte[] userSuppliedTag)
   throws FederateInternalError;
}
//end ValidateAnnounceSynchronizationPoint
```

```
// File: ValidateAttributeIsNotOwned.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateAttributeIsNotOwned
{
   /**
    * Validates the attributeIsNotOwned callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttribute an AttributeHandle specifying the attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#attributeIsNotOwned
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;
}
//end ValidateAttributeIsNotOwned
```

```
// File: ValidateAttributeIsOwnedByRTI.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateAttributeIsOwnedByRTI
{
   /**
    * Validates the attributeIsOwnedByRTI callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttribute an AttributeHandle specifying the attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#attributeIsOwnedByRTI
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;
}
//end ValidateAttributeIsOwnedByRTI
```

```
// File: ValidateAttributeOwnershipAcquisitionNotification.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateAttributeOwnershipAcquisitionNotification
{
   /**
    * Validates the attributeOwnershipAcquisitionNotification
callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param securedAttributes an AttributeHandleSet specifying the
secured attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAcquisitionWasNotRequested should be thrown if
the federate repudiates its attribute ownership acquisition request
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeNotPublished should be thrown if the federate
denies publishing an attribute
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#attributeOwnershipAcquisitionNotificati
on
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   securedAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAcquisitionWasNotRequested,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError;
}
//end ValidateAttributeOwnershipAcquisitionNotification
```

```
// File: ValidateAttributeOwnershipUnavailable.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateAttributeOwnershipUnavailable
{
   /**
    * Validates the attributeOwnershipUnavailable callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleSet specifying the
declined attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeAcquisitionWasNotRequested should be thrown if
the federate repudiates its attribute ownership acquisition request
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#attributeOwnershipUnavailable
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotRequested,
          FederateInternalError;
}
//end ValidateAttributeOwnershipUnavailable
```

```
// File: ValidateAttributesInScope.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateAttributesInScope
{
   /**
    * Validates the attributesInScope callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleSet specifying the
pertinent attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#attributesInScope
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
}
//end ValidateAttributesInScope
```

```
// File: ValidateAttributesOutOfScope.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateAttributesOutOfScope
{
   /**
    * Validates the attributesOutOfScope callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleSet specifying the
pertinent attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#attributesOutOfScope
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
}
//end ValidateAttributesOutOfScope
```

```
// File: ValidateConfirmAttributeOwnershipAcquisitionCancellation.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateConfirmAttributeOwnershipAcquisitionCancellation
{
   /**
    * Validates the confirmAttributeOwnershipAcquisitionCancellation
callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleSet specifying the
subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeAcquisitionWasNotCanceled should be thrown if
the federate repudiates the attribute ownership acquisition
cancellation
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#confirmAttributeOwnershipAcquisitionCan
cellation
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotCanceled,
          FederateInternalError;
}
//end ValidateConfirmAttributeOwnershipAcquisitionCancellation
```

```
// File: ValidateDiscoverObjectInstance.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateDiscoverObjectInstance
{
   /**
    * Validates the discoverObjectInstance callback.
    * @param theObject the ObjectInstanceHandle of the newly
discovered object instance
    * @param theObjectClass the ObjectClassHandle of the class the
instance was discovered as
    * @param objectName a String holding the newly discovered object
instance's name
    * @throws CouldNotDiscover should be thrown if the object instance
could not be discovered for some reason other than an unrecognized
object class
    * @throws ObjectClassNotRecognized should be thrown if the
federate does not recognize <code>theObjectClass</code>
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#discoverObjectInstance
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      ObjectClassHandle    theObjectClass,
      String               objectName)
   throws CouldNotDiscover,
          ObjectClassNotRecognized,
          FederateInternalError;
}
//end ValidateDiscoverObjectInstance
```

```
// File: ValidateFederationNotRestored.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationNotRestored
{
   /**
    * Validates the federationNotRestored callback.
    * @param reason a RestoreFailureReason specifying the reason for
the failure
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#federationNotRestored
    */
   public void
   validate(
      RestoreFailureReason reason)
   throws FederateInternalError;
}
//end ValidateFederationNotRestored
```

```
// File: ValidateFederationNotSaved.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationNotSaved
{
   /**
    * Validates the federationNotSaved callback.
    * @param reason a SaveFailureReason specifying why the save failed
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#federationNotSaved
    */
   public void
   validate(
      SaveFailureReason reason)
   throws FederateInternalError;
}
//end ValidateFederationNotSaved
```

```
// File: ValidateFederationRestoreBegun.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationRestoreBegun
{
   /**
    * Validates the federationRestoreBegun callback.
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#federationRestoreBegun
    */
   public void
   validate()
   throws FederateInternalError;
}
//end ValidateFederationRestoreBegun
```

```
// File: ValidateFederationRestored.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationRestored
{
   /**
    * Validates the federationRestored callback.
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#federationRestored
    */
   public void
   validate()
   throws FederateInternalError;
}
//end ValidateFederationRestored
```

```
// File: ValidateFederationRestoreStatusResponse.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationRestoreStatusResponse
{
   /**
    * Validates the federationRestoreStatusResponse callback.
    * @param response a FederateHandleRestoreStatusPair[] specifying
the RestoreStatus of each federate
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see
hla.rti1516.FederateAmbassador#federationRestoreStatusResponse
    */
   public void
   validate(
      FederateHandleRestoreStatusPair[] response)
   throws FederateInternalError;
}
//end ValidateFederationRestoreStatusResponse
```

```
// File: ValidateFederationSaved.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationSaved
{
   /**
    * Validates the federationSaved callback.
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#federationSaved
    */
   public void
   validate()
   throws FederateInternalError;
}
//end ValidateFederationSaved
```

```
// File: ValidateFederationSaveStatusResponse.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationSaveStatusResponse
{
   /**
    * Validates the federationSaveStatusResponse callback.
    * @param response a FederateHandleSaveStatusPair[] specifying the
SaveStatus of each federate
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#federationSaveStatusResponse
    */
   public void
   validate(
      FederateHandleSaveStatusPair[] response)
   throws FederateInternalError;
}
//end ValidateFederationSaveStatusResponse
```

```
// File: ValidateFederationSynchronized.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateFederationSynchronized
{
   /**
    * Validates the federationSynchronized callback arguments.
    * @param synchronizationPointLabel a String giving the
synchronization point's identifier
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#federationSynchronized
    */
   public void
   validate(
      String synchronizationPointLabel)
   throws FederateInternalError;
}
//end ValidateFederationSynchronized
```

```
// File: ValidateInformAttributeOwnership.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateInformAttributeOwnership
{
   /**
    * Validates the informAttributeOwnership callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttribute an AttributeHandle specifying the attribute
    * @param theOwner the FederateHandle of the federate owning the
attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#informAttributeOwnership
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute,
      FederateHandle       theOwner)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;
}
//end ValidateInformAttributeOwnership
```

```
// File: ValidateInitiateFederateRestore.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateInitiateFederateRestore
{
   /**
    * Validates the initiateFederateRestore callback.
    * @param label a String holding the saved state's identifier
    * @param federateHandle the FederateHandle that the federate will
assume if and once it receives the federationRestored callback
    * @throws SpecifiedSaveLabelDoesNotExist should be thrown if the
label isn't recognized
    * @throws CouldNotInitiateRestore should be thrown if the federate
is unwilling or unable to initiate the restore operation
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#initiateFederateRestore
    */
   public void
   validate(
      String         label,
      FederateHandle federateHandle)
   throws SpecifiedSaveLabelDoesNotExist,
          CouldNotInitiateRestore,
          FederateInternalError;
}
//end ValidateInitiateFederateRestore
```

```
// File: ValidateInitiateFederateSave.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateInitiateFederateSave
{
   /**
    * Validates the initiateFederateSave callback arguments (timeless
form).
    * @param label a String holding the saved state's identifier
    * @throws UnableToPerformSave should be thrown if the save
operation seems doomed
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#initiateFederateSave
    */
   public void
   validate(
      String label)
   throws UnableToPerformSave,
          FederateInternalError;
   /**
    * Validates the initiateFederateSave callback arguments (timefull
form).
    * @param label a String holding the saved state's identifier
    * @param time a LogicalTime specifying when the save was scheduled
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws UnableToPerformSave should be thrown if the save
operation seems doomed
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#initiateFederateSave
    */
   public void
   validate(
      String      label,
      LogicalTime time)
   throws InvalidLogicalTime,
          UnableToPerformSave,
          FederateInternalError;
}
//end ValidateInitiateFederateSave
```

```
// File: ValidateObjectInstanceNameReservationFailed.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateObjectInstanceNameReservationFailed
{
   /**
    * Validates the objectInstanceNameReservationFailed callback.
    * @param objectName a String holding the requested object name
    * @throws UnknownName should be thrown if the federate denies
requesting to reserve the <code>objectName</code>
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#objectInstanceNameReservationFailed
    */
   public void
   validate(
      String objectName)
   throws UnknownName,
          FederateInternalError;
}
//end ValidateObjectInstanceNameReservationFailed
```

```
// File: ValidateObjectInstanceNameReservationSucceeded.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateObjectInstanceNameReservationSucceeded
{
   /**
    * Validates the objectInstanceNameReservationSucceeded callback.
    * @param objectName a String holding the requested object name
    * @throws UnknownName should be thrown if the federate denies
requesting to reserve the <code>objectName</code>
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#objectInstanceNameReservationSucceeded
    */
   public void
   validate(
      String objectName)
   throws UnknownName,
          FederateInternalError;
}
//end ValidateObjectInstanceNameReservationSucceeded
```

```
// File: ValidateProvideAttributeValueUpdate.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateProvideAttributeValueUpdate
{
   /**
    * Validates the provideAttributeValueUpdate callback.
    * @param theObject the ObjectInstanceHandle of the subject object
instance
    * @param theAttributes an AttributeHandleSet specifying the
requested attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#provideAttributeValueUpdate
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
}
//end ValidateProvideAttributeValueUpdate
```

```
// File: ValidateReceiveInteraction.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateReceiveInteraction
{
   /**
    * Validates the receiveInteraction callback (base form).
    * @param interactionClass the InteractionClassHandle of the
received interaction
    * @param theParameters a ParameterHandleValueMap specifying the
interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the interaction was sent as
    * @param theTransport the TransportationType used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#receiveInteraction
    */
   public void
   validate(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Validates the receiveInteraction callback (second form).
    * @param interactionClass the InteractionClassHandle of the
received interaction
    * @param theParameters a ParameterHandleValueMap specifying the
interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the interaction was sent as
    * @param theTransport the TransportationType used to send the
interaction
    * @param sentRegions the RegionHandleSet used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#receiveInteraction
    */
   public void
   validate(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Validates the receiveInteraction callback (third form).
    * @param interactionClass the InteractionClassHandle of the
received interaction
    * @param theParameters a ParameterHandleValueMap specifying the
interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the interaction was sent as
    * @param theTransport the TransportationType used to send the
interaction
    * @param theTime the LogicalTime at which the interaction occurs
    * @param receivedOrdering the OrderType the passel was received as
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#receiveInteraction
    */
   public void
   validate(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Validates the receiveInteraction callback (fourth form).
    * @param interactionClass the InteractionClassHandle of the
received interaction
    * @param theParameters a ParameterHandleValueMap specifying the
interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the interaction was sent as
    * @param theTransport the TransportationType used to send the
interaction
    * @param theTime the LogicalTime at which the interaction occurs
    * @param receivedOrdering the OrderType the passel was received as
    * @param sentRegions the RegionHandleSet used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#receiveInteraction
    */
   public void
   validate(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Validates the receiveInteraction callback (fifth form).
    * @param interactionClass the InteractionClassHandle of the
received interaction
    * @param theParameters a ParameterHandleValueMap specifying the
interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the interaction was sent as
    * @param theTransport the TransportationType used to send the
interaction
    * @param theTime the LogicalTime at which the interaction occurs
    * @param receivedOrdering the OrderType the passel was received as
    * @param messageRetractionHandle the MessageRetractionHandle of
the message
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#receiveInteraction
    */
   public void
   validate(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
   /**
    * Validates the receiveInteraction callback (full form).
    * @param interactionClass the InteractionClassHandle of the
received interaction
    * @param theParameters a ParameterHandleValueMap specifying the
interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the interaction was sent as
    * @param theTransport the TransportationType used to send the
interaction
    * @param theTime the LogicalTime at which the interaction occurs
    * @param receivedOrdering the OrderType the passel was received as
    * @param messageRetractionHandle the MessageRetractionHandle of
the message
    * @param sentRegions the RegionHandleSet used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#receiveInteraction
    */
   public void
   validate(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
}
//end ValidateReceiveInteraction
```

```
// File: ValidateReflectAttributeValues.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateReflectAttributeValues
{
   /**
    * Validates the reflectAttributeValues callback (base form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleValueMap specifying the
new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the passel was sent as
    * @param theTransport the TransportationType used to send the
passel
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#reflectAttributeValues
    */
   public void
   validate(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Validates the reflectAttributeValues callback (second form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleValueMap specifying the
new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the passel was sent as
    * @param theTransport the TransportationType used to send the
passel
    * @param sentRegions the RegionHandleSet used to send the update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#reflectAttributeValues
    */
   public void
   validate(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Validates the reflectAttributeValues callback (third form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleValueMap specifying the
new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the passel was sent as
    * @param theTransport the TransportationType used to send the
passel
    * @param theTime the LogicalTime at which the update comes into
effect
    * @param receivedOrdering the OrderType the passel was received as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#reflectAttributeValues
    */
   public void
   validate(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Validates the reflectAttributeValues callback (fourth form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleValueMap specifying the
new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the passel was sent as
    * @param theTransport the TransportationType used to send the
passel
    * @param theTime the LogicalTime at which the update comes into
effect
    * @param receivedOrdering the OrderType the passel was received as
    * @param sentRegions the RegionHandleSet used to send the update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#reflectAttributeValues
    */
   public void
   validate(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
      AttributeNotRecognized,
      AttributeNotSubscribed,
      FederateInternalError;
   /**
    * Validates the reflectAttributeValues callback (fifth form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleValueMap specifying the
new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the passel was sent as
    * @param theTransport the TransportationType used to send the
passel
    * @param theTime the LogicalTime at which the update comes into
effect
    * @param receivedOrdering the OrderType the passel was received as
    * @param retractionHandle the MessageRetractionHandle of the
message
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#reflectAttributeValues
    */
   public void
   validate(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
   /**
    * Validates the reflectAttributeValues callback (full form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param theAttributes an AttributeHandleValueMap specifying the
new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the passel was sent as
    * @param theTransport the TransportationType used to send the
passel
    * @param theTime the LogicalTime at which the update comes into
effect
    * @param receivedOrdering the OrderType the passel was received as
    * @param retractionHandle the MessageRetractionHandle of the
message
    * @param sentRegions the RegionHandleSet used to send the update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#reflectAttributeValues
    */
   public void
   validate(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
}
//end ValidateReflectAttributeValues
```

```
// File: ValidateRemoveObjectInstance.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateRemoveObjectInstance
{
   /**
    * Validates the removeObjectInstance callback (base form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the message was sent as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#removeObjectInstance
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      byte[]               userSuppliedTag,
      OrderType            sentOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError;
   /**
    * Validates the removeObjectInstance callback (second form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the message was sent as
    * @param theTime the LogicalTime at which the deletion occurs
    * @param receivedOrdering the OrderType the message was received
as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#removeObjectInstance
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      byte[]               userSuppliedTag,
      OrderType            sentOrdering,
      LogicalTime          theTime,
      OrderType            receivedOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError;
   /**
    * Validates the removeObjectInstance callback (full form).
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the OrderType the message was sent as
    * @param theTime the LogicalTime at which the deletion occurs
    * @param receivedOrdering the OrderType the message was received
as
    * @param retractionHandle the MessageRetractionHandle of the
message
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#removeObjectInstance
    */
   public void
   validate(
      ObjectInstanceHandle    theObject,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          InvalidLogicalTime,
          FederateInternalError;
}
//end ValidateRemoveObjectInstance
```

```
// File: ValidateRequestAttributeOwnershipAssumption.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateRequestAttributeOwnershipAssumption
{
   /**
    * Validates the requestAttributeOwnershipAssumption callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param offeredAttributes an AttributeHandleSet specifying the
offered attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeNotPublished should be thrown if the federate
denies publishing an attribute
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#requestAttributeOwnershipAssumption
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError;
}
//end ValidateRequestAttributeOwnershipAssumption
```

```
// File: ValidateRequestAttributeOwnershipRelease.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateRequestAttributeOwnershipRelease
{
   /**
    * Validates the requestAttributeOwnershipRelease callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param candidateAttributes an AttributeHandleSet specifying the
candidate attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#requestAttributeOwnershipRelease
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   candidateAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
}
//end ValidateRequestAttributeOwnershipRelease
```

```
// File: ValidateRequestDivestitureConfirmation.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateRequestDivestitureConfirmation
{
   /**
    * Validates the requestDivestitureConfirmation callback.
    * @param theObject the ObjectInstanceHandle of the concerned
object instance
    * @param offeredAttributes an AttributeHandleSet specifying the
offered attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws AttributeDivestitureWasNotRequested should be thrown if
the federate repudiates the divestiture
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#requestDivestitureConfirmation
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          AttributeDivestitureWasNotRequested,
          FederateInternalError;
}
//end ValidateRequestDivestitureConfirmation
```

```
// File: ValidateRequestFederationRestoreFailed.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateRequestFederationRestoreFailed
{
   /**
    * Validates the requestFederationRestoreFailed callback.
    * @param label a String holding the saved state's identifier
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see
hla.rti1516.FederateAmbassador#requestFederationRestoreFailed
    */
   public void
   validate(
      String label)
   throws FederateInternalError;
}
//end ValidateRequestFederationRestoreFailed
```

```
// File: ValidateRequestFederationRestoreSucceeded.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateRequestFederationRestoreSucceeded
{
   /**
    * Validates the requestFederationRestoreSucceeded callback.
    * @param label a String holding the saved state's identifier
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see
hla.rti1516.FederateAmbassador#requestFederationRestoreSucceeded
    */
   public void
   validate(
      String label)
   throws FederateInternalError;
}
//end ValidateRequestFederationRestoreSucceeded
```

```
// File: ValidateRequestRetraction.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateRequestRetraction
{
   /**
    * Validates the requestRetraction callback.
    * @param theHandle the MessageRetractionHandle specifying the
retracted message
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see hla.rti1516.FederateAmbassador#requestRetraction
    */
   public void
   validate(
      MessageRetractionHandle theHandle)
   throws FederateInternalError;
}
//end ValidateRequestRetraction
```

```
// File: ValidateStartRegistrationForObjectClass.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateStartRegistrationForObjectClass
{
   /**
    * Validates the startRegistrationForObjectClass callback.
    * @param theClass the ObjectClassHandle of the subject object
class
    * @throws ObjectClassNotPublished should be thrown if the federate
denies publishing <code>theClass</code>
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#startRegistrationForObjectClass
    */
   public void
   validate(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError;
}
//end ValidateStartRegistrationForObjectClass
```

```
// File: ValidateStopRegistrationForObjectClass.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateStopRegistrationForObjectClass
{
   /**
    * Validates the stopRegistrationForObjectClass callback.
    * @param theClass the ObjectClassHandle of the subject object
class
    * @throws ObjectClassNotPublished should be thrown if the federate
denies publishing <code>theClass</code>
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#stopRegistrationForObjectClass
    */
   public void
   validate(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError;
}
//end ValidateStopRegistrationForObjectClass
```

```
// File: ValidateSynchronizationPointRegistrationFailed.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateSynchronizationPointRegistrationFailed
{
   /**
    * Validates the synchronizationPointRegistrationFailed callback
arguments.
    * @param synchronizationPointLabel a String giving the
synchronization point's identifier
    * @param reason a SynchronizationPointFailureReason specifying
what went wrong
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see
hla.rti1516.FederateAmbassador#synchronizationPointRegistrationFailed
    */
   public void
   validate(
      String                            synchronizationPointLabel,
      SynchronizationPointFailureReason reason)
   throws FederateInternalError;
}
//end ValidateSynchronizationPointRegistrationFailed
```

```
// File: ValidateSynchronizationPointRegistrationSucceeded.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateSynchronizationPointRegistrationSucceeded
{
   /**
    * Validates the SynchronizationPointRegistrationSucceeded callback
arguments.
    * @param synchronizationPointLabel a String giving the
synchronization point's identifier
    * @throws FederateInternalError should be thrown if something is
wrong
    * @see
hla.rti1516.FederateAmbassador#synchronizationPointRegistrationSucceed
ed
    */
   public void
   validate(
      String synchronizationPointLabel)
   throws FederateInternalError;
}
//end ValidateSynchronizationPointRegistrationSucceeded
```

```
// File: ValidateTimeAdvanceGrant.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateTimeAdvanceGrant
{
   /**
    * Validates the timeAdvanceGrant callback.
    * @param theTime the LogicalTime to which the federate's clock has
been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws JoinedFederateIsNotInTimeAdvancingState should be thrown
if the federate does not consider itself in the time-advancing state
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#timeAdvanceGrant
    */
   public void
   validate(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          JoinedFederateIsNotInTimeAdvancingState,
          FederateInternalError;
}
//end ValidateTimeAdvanceGrant
```

```
// File: ValidateTimeConstrainedEnabled.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateTimeConstrainedEnabled
{
   /**
    * Validates the timeConstrainedEnabled callback.
    * @param time the LogicalTime to which the federate's clock has
been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws NoRequestToEnableTimeConstrainedWasPending should be
thrown if the federate repudiates the time constraint request
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#timeConstrainedEnabled
    */
   public void
   validate(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeConstrainedWasPending,
          FederateInternalError;
}
//end ValidateTimeConstrainedEnabled
```

```
// File: ValidateTimeRegulationEnabled.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateTimeRegulationEnabled
{
   /**
    * Validates the timeRegulationEnabled callback.
    * @param time the LogicalTime to which the federate's clock has
been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws NoRequestToEnableTimeRegulationWasPending should be
thrown if the federate repudiates the time regulation request
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#timeRegulationEnabled
    */
   public void
   validate(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeRegulationWasPending,
          FederateInternalError;
}
//end ValidateTimeRegulationEnabled
```

```
// File: ValidateTurnInteractionsOff.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateTurnInteractionsOff
{
   /**
    * Validates the turnInteractionsOff callback.
    * @param theHandle the InteractionClassHandle of the subject
interaction class
    * @throws InteractionClassNotPublished should be thrown if the
federate denies publishing <code>theHandle</code>
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#turnInteractionsOff
    */
   public void
   validate(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError;
}
//end ValidateTurnInteractionsOff
```

```
// File: ValidateTurnInteractionsOn.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateTurnInteractionsOn
{
   /**
    * Validates the turnInteractionsOn callback.
    * @param theHandle the InteractionClassHandle of the subject
interaction class
    * @throws InteractionClassNotPublished should be thrown if the
federate denies publishing <code>theHandle</code>
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see hla.rti1516.FederateAmbassador#turnInteractionsOn
    */
   public void
   validate(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError;
}
//end ValidateTurnInteractionsOn
```

```
// File: ValidateTurnUpdatesOffForObjectInstance.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateTurnUpdatesOffForObjectInstance
{
   /**
    * Validates the turnUpdatesOffForObjectInstance callback.
    * @param theObject the ObjectInstanceHandle of the subject object
instance
    * @param theAttributes an AttributeHandleSet specifying the
subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#turnUpdatesOffForObjectInstance
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
}
//end ValidateTurnUpdatesOffForObjectInstance
```

```
// File: ValidateTurnUpdatesOnForObjectInstance.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * This interface is meant to be implemented by validation handlers;
 * these are called first by the callback handler.
 * In each case, there is but one method: validate(), which accepts
 * the same arguments as the corresponding callback (overloaded as
 * needed). Likewise, the method throws the same exceptions as the
 * callback. If no exception is thrown, all is well.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface
ValidateTurnUpdatesOnForObjectInstance
{
   /**
    * Validates the turnUpdatesOnForObjectInstance callback.
    * @param theObject the ObjectInstanceHandle of the subject object
instance
    * @param theAttributes an AttributeHandleSet specifying the
subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
is wrong
    * @see
hla.rti1516.FederateAmbassador#turnUpdatesOnForObjectInstance
    */
   public void
   validate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
}
//end ValidateTurnUpdatesOnForObjectInstance
```

The FederateAmbassadorSynchronization interface is the FederateAmbassador part devoted to the federation synchronization callbacks.

```
// File: FederateAmbassadorSynchronization.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Synchronization callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorSynchronization
{
   ////////////////////////////////////////////////////
   // Federation Management Services - Synchronization
   ////////////////////////////////////////////////////

   // 4.7
   /**
    * Notifies the federate that it has successfully registered a
federation synchronization point.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see #announceSynchronizationPoint announceSynchronizationPoint
    * @see #federationSynchronized federationSynchronized
    */
   public void
   synchronizationPointRegistrationSucceeded(
      String synchronizationPointLabel)
   throws FederateInternalError;
   /**
    * Notifies the federate that it has failed to registered a
federation synchronization point.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @param reason a {@link SynchronizationPointFailureReason}
specifying what went wrong
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see #announceSynchronizationPoint announceSynchronizationPoint
    * @see #federationSynchronized federationSynchronized
    */
   public void
   synchronizationPointRegistrationFailed(
      String                            synchronizationPointLabel,
      SynchronizationPointFailureReason reason)
   throws FederateInternalError;
   // 4.8
   /**
    * Notifies the federate that a synchronization point exists.
    * Achievement of the point is signalled to the RTI through the
    * {@link RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved} method.
    * <p>
    * Federates are by default part of the synchronization set, unless
a {@link FederateHandleSet} has been specifically
    * supplied to the {@link
RTIambassador#registerFederationSynchronizationPoint(String,byte[],Fed
erateHandleSet)} method.
    * A federate that resigns is simply removed from the
synchronization set.
    * The synchronization point exists until it has been achieved by
all concerned federates, which could be
    * until the federation execution concludes.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see #synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see #federationSynchronized federationSynchronized
    */
   public void
   announceSynchronizationPoint(
      String synchronizationPointLabel,
      byte[] userSuppliedTag)
   throws FederateInternalError;
   // 4.10
   /**
    * Informs the joined federate that all members of the
synchronization set of the specified synchronization point
    * have invoked the {@link
RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved} method for that point.
    * The synchronization point ceases to exist once this callback has
been invoked on all concerned federates.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see RTIambassador#synchronizationPointAchieved
synchronizationPointAchieved
    * @see #synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see #synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    * @see #announceSynchronizationPoint announceSynchronizationPoint
    */
   public void
   federationSynchronized(
      String synchronizationPointLabel)
   throws FederateInternalError;
}
//end FederateAmbassadorSynchronization
```

The `FederateAmbassadorSave` interface is the `FederateAmbassador` part devoted to the federation save callbacks.

```
// File: FederateAmbassadorSave.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Save callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorSave
{
   ////////////////////////////////////////
   // Federation Management Services - Save
   ////////////////////////////////////////

   // 4.12
   /**
    * Instructs the joined federate that it is now in the Instructed
To Save state
    * and should therefore save state as soon as possible.
    * The joined federate should use the supplied <code>label</code>,
    * the name of the federation execution (see the
<code>federationExecutionName</code>
    * of the {@link RTIambassador#joinFederationExecution
joinFederationExecution} invocation),
    * its joined federate designator (returned by the aforementioned
invocation) and
    * its federate type (the aforementioned invocation's
<code>federateType</code> argument)
    * to distinguish the saved state information.
    * <p>
    * A federate that is not time constrained should expect this
callback at any point.
    * A time constrained federate can receive this callback only
whilst in the Time Advancing state.
    * Once in the Instructed To Save state, the federate is severely
limited in which RTIambassador
    * methods it can invoke. This lasts through the Saving and Waiting
For Federation To Save states,
    * concluding with the {@link #federationSaved federationSaved} or
    * {@link #federationNotSaved federationNotSaved} callbacks.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws UnableToPerformSave should be thrown if the save
operation seems doomed
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   initiateFederateSave(
      String label)
   throws UnableToPerformSave,
          FederateInternalError;
   /**
    * Instructs the joined federate that it is now in the Instructed
To Save state
    * (as of the specified <code>time</code>) and should therefore
save state as soon as possible.
    * <p>
    * For details, see the {@link #initiateFederateSave(String)}
callback.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @param time a {@link LogicalTime} specifying when the save was
scheduled
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws UnableToPerformSave should be thrown if the save
operation seems doomed
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #federationSaved federationSaved
    * @see #federationNotSaved federationNotSaved
    * @see #federationSaveStatusResponse federationSaveStatusResponse
    */
   public void
   initiateFederateSave(
      String      label,
      LogicalTime time)
   throws InvalidLogicalTime,
          UnableToPerformSave,
          FederateInternalError;
   // 4.15
   /**
    * Informs the joined federate that the federation save process is
complete and successfull.
    * <p>
    * All joined federates at which the {@link #initiateFederateSave
initiateFederateSave} callback
    * was invoked have in turn invoked the {@link
RTIambassador#federateSaveComplete federateSaveComplete} method.
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #initiateFederateSave initiateFederateSave
    * @see #federationNotSaved federationNotSaved
    * @see #federationSaveStatusResponse federationSaveStatusResponse
    */
   public void
   federationSaved()
   throws FederateInternalError;
   /**
    * Informs the joined federate that the federation save process has
completed in failure.
    * <p>
    * The possible save failure reasons are:
    * <ul>
    * <li> RTI_UNABLE_TO_SAVE: The RTI was unable to save
    * <li> FEDERATE_REPORTED_FAILURE: One or more joined federates
have invoked the {@link RTIambassador#federateSaveNotComplete
federateSaveNotComplete} method
    * <li> FEDERATE_RESIGNED: One or more joined federates have
resigned from the federation execution
    * <li> RTI_DETECTED_FAILURE: The RTI has detected failure at one
or more of the joined federates
    * <li> SAVE_TIME_CANNOT_BE_HONORED: The time stamp specified by
the {@link RTIambassador#requestFederationSave(String,LogicalTime)}
    * request cannot be honored, due to possible race conditions in
the distributed calculation of GALT (Greatest Available Logical Time)
    * </ul>
    * @param reason a {@link SaveFailureReason} specifying why the
save failed
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #initiateFederateSave initiateFederateSave
    * @see #federationSaved federationSaved
    * @see #federationSaveStatusResponse federationSaveStatusResponse
    */
   public void
   federationNotSaved(
      SaveFailureReason reason)
   throws FederateInternalError;
   // 4.17
   /**
    * Supplies the federate with the previously requested save status
indicators.
    * @param response a {@link FederateHandleSaveStatusPair}[]
specifying the {@link SaveStatus} of each federate
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationSave requestFederationSave
    * @see RTIambassador#federateSaveBegun federateSaveBegun
    * @see RTIambassador#federateSaveComplete federateSaveComplete
    * @see RTIambassador#federateSaveNotComplete
federateSaveNotComplete
    * @see RTIambassador#queryFederationSaveStatus
queryFederationSaveStatus
    * @see #initiateFederateSave initiateFederateSave
    * @see #federationSaved federationSaved
    * @see #federationNotSaved federationNotSaved
    */
   public void
   federationSaveStatusResponse(
      FederateHandleSaveStatusPair[] response)
   throws FederateInternalError;
}
//end FederateAmbassadorSave
```

The `FederateAmbassadorRestore` interface is the `FederateAmbassador` part devoted to the federation restoration callbacks.

```
// File: FederateAmbassadorRestore.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Restore callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorRestore
{
   ///////////////////////////////////////////
   // Federation Management Services - Restore
   ///////////////////////////////////////////

   // 4.19
   /**
    * Indicates that the federate's previous {@link
RTIambassador#requestFederationRestore requestFederationRestore} has
been granted.
    * <p>
    * This means the RTI has located the RTI-specific saved state
information matching the previously supplied
    * <code>label</code>, {@link RTIambassador#joinFederationExecution
federationExecutionName} and
    * {@link RTIambassador#createFederationExecution fdd}, and that
the census of currently joined
    * federates matches in number and {@link
RTIambassador#joinFederationExecution federateType} that of the
    * RTI's saved state.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   requestFederationRestoreSucceeded(
      String label)
   throws FederateInternalError;
   /**
    * Indicates that the federate's previous {@link
RTIambassador#requestFederationRestore requestFederationRestore} has
been denied.
    * <p>
    * This means the RTI failed to locate its specific saved state
information or that the census of
    * currently joined federates does not match in number and {@link
RTIambassador#joinFederationExecution federateType}
    * that of the retrieved RTI saved state.
    * Failures by individual federates to complete the restoration
process lead to the
    * {@link #federationNotRestored federationNotRestored} callback
instead.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   requestFederationRestoreFailed(
      String label)
   throws FederateInternalError;
   // 4.20
   /**
    * Instructs the joined federate that it is now in the Prepared To
Restore state
    * and should prepare to proceed with saved state restoration. The
necessary information
    * is later provided by the {@link #initiateFederateRestore
initiateFederateRestore} callback.
    * <p>
    * Once in the Prepared To Restore state, the federate is severely
limited in which RTIambassador
    * methods it can invoke. This lasts through the Restoring and
Waiting For Federation To Restore states,
    * concluding with the {@link #federationRestored
federationRestored} or
    * {@link #federationNotRestored federationNotRestored} callbacks.
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federationRestoreBegun()
   throws FederateInternalError;
   // 4.21
   /**
    * Instructs the joined federate to return to a previously saved
state.
    * The joined federate should use the supplied <code>label</code>,
    * the name of the federation execution (see the
<code>federationExecutionName</code>
    * of the {@link RTIambassador#joinFederationExecution
joinFederationExecution} invocation),
    * the supplied federate designator (<code>federateHandle</code>)
and
    * its federate type (the aforementioned invocation's
<code>federateType</code> argument)
    * to retrieve the saved state information.
    * <p>
    * Note that the supplied <code>federateHandle</code> may differ
from the federate's current {@link FederateHandle};
    * it will assume this new designator if and once it receives the
{@link #federationRestored federationRestored} callback.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @param federateHandle the {@link FederateHandle} that the
federate will assume if and once it receives the {@link
#federationRestored federationRestored} callback
    * @throws SpecifiedSaveLabelDoesNotExist should be thrown if the
label isn't recognized
    * @throws CouldNotInitiateRestore should be thrown if the federate
is unwilling or unable to initiate the restore operation
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   initiateFederateRestore(
      String         label,
      FederateHandle federateHandle)
   throws SpecifiedSaveLabelDoesNotExist,
          CouldNotInitiateRestore,
          FederateInternalError;
   // 4.23
   /**
    * Informs the joined federate that the federation restore process
is complete and successfull.
    * This means that all joined federates which received the {@link
#federationRestoreBegun federationRestoreBegun}
    * callback have invoked the {@link
RTIambassador#federateRestoreComplete federateRestoreComplete} method.
    * The federate's {@link FederateHandle} is now the one that was
supplied by the {@link #initiateFederateRestore
initiateFederateRestore} callback.
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationNotRestored federationNotRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federationRestored()
   throws FederateInternalError;
   /**
    * Informs the joined federate that the federation restore process
has completed in failure.
    * <p>
    * The possible save failure reasons are:
    * <ul>
    * <li> RTI_UNABLE_TO_RESTORE: The RTI was unable to restore
    * <li> FEDERATE_REPORTED_FAILURE: One or more federates have
invoked the {@link RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete} method
    * <li> FEDERATE_RESIGNED: One or more joined federates have
resigned from the federation execution
    * <li> RTI_DETECTED_FAILURE: The RTI has detected failure at one
or more of the joined federates
    * </ul>
    * @param reason a {@link RestoreFailureReason} specifying the
reason for the failure
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationRestoreStatusResponse
federationRestoreStatusResponse
    */
   public void
   federationNotRestored(
      RestoreFailureReason reason)
   throws FederateInternalError;
   // 4.25
   /**
    * Supplies the federate with the previously requested restore
status indicators.
    * @param response a {@link FederateHandleRestoreStatusPair}[]
specifying the {@link RestoreStatus} of each federate
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see RTIambassador#federateRestoreComplete
federateRestoreComplete
    * @see RTIambassador#federateRestoreNotComplete
federateRestoreNotComplete
    * @see RTIambassador#queryFederationRestoreStatus
queryFederationRestoreStatus
    * @see #requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see #requestFederationRestoreFailed
requestFederationRestoreFailed
    * @see #federationRestoreBegun federationRestoreBegun
    * @see #initiateFederateRestore initiateFederateRestore
    * @see #federationRestored federationRestored
    * @see #federationNotRestored federationNotRestored
    */
   public void
   federationRestoreStatusResponse(
      FederateHandleRestoreStatusPair[] response)
   throws FederateInternalError;
}
//end FederateAmbassadorRestore
```

The FederateAmbassadorObjectRegistrationAdvisory interface is the FederateAmbassador part devoted to the object class relevance advisories.

```
// File: FederateAmbassadorObjectRegistrationAdvisory.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the object class relevance advisories (i.e. the
Registration Advisory callbacks).
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorObjectRegistrationAdvisory
{
   ////////////////////////////////////////////////////////////
   // Declaration Management Services - Registration Advisories
   ////////////////////////////////////////////////////////////

   // 5.10
   /**
    * Notifies the federate that registration of new object instances
of the specified object class
    * is advised because at least one of the federate-published class
attributes is actively subscribed to
    * by at least one other federate.
    * This occurs only if the federate's Object Class Relevance
Advisory Switch is turned on.
    * @param theClass the {@link ObjectClassHandle} of the subject
object class
    * @throws ObjectClassNotPublished should be thrown if the federate
denies publishing <code>theClass</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #stopRegistrationForObjectClass
stopRegistrationForObjectClass
    * @see RTIambassador#enableObjectClassRelevanceAdvisorySwitch
enableObjectClassRelevanceAdvisorySwitch
    * @see RTIambassador#disableObjectClassRelevanceAdvisorySwitch
disableObjectClassRelevanceAdvisorySwitch
    */
   public void
   startRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError;
   // 5.11
   /**
    * Notifies the federate that registration of new object instances
of the specified object class
    * is not advised because there are no active subscribers to any of
the federate-published class attributes.
    * This occurs only if the federate's Object Class Relevance
Advisory Switch is turned on.
    * @param theClass the {@link ObjectClassHandle} of the subject
object class
    * @throws ObjectClassNotPublished should be thrown if the federate
denies publishing <code>theClass</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see RTIambassador#enableObjectClassRelevanceAdvisorySwitch
enableObjectClassRelevanceAdvisorySwitch
    * @see RTIambassador#disableObjectClassRelevanceAdvisorySwitch
disableObjectClassRelevanceAdvisorySwitch
    */
   public void
   stopRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError;
}
//end FederateAmbassadorObjectRegistrationAdvisory
```

The `FederateAmbassadorInteractionAdvisory` interface is the `FederateAmbassador` part devoted to the server (publisher) interaction scope advisories.

```
// File: FederateAmbassadorInteractionAdvisory.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Interaction Scope Advisory callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorInteractionAdvisory
{
   ////////////////////////////////////////////////////////
   // Declaration Management Services - Interaction Advisory
   ////////////////////////////////////////////////////////

   // 5.12
   /**
    * Notifies the federate that the specified class of interactions
is relevant because
    * there is at least one active subscription by another federate.
    * This occurs only if the federate's Interaction Relevance
Advisory Switch is turned on.
    * @param theHandle the {@link InteractionClassHandle} of the
subject interaction class
    * @throws InteractionClassNotPublished should be thrown if the
federate denies publishing <code>theHandle</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnInteractionsOff turnInteractionsOff
    * @see RTIambassador#enableInteractionRelevanceAdvisorySwitch
enableInteractionRelevanceAdvisorySwitch
    * @see RTIambassador#disableInteractionRelevanceAdvisorySwitch
disableInteractionRelevanceAdvisorySwitch
    */
   public void
   turnInteractionsOn(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError;
   // 5.13
   /**
    * Notifies the federate that the specified class of interactions
is not relevant because
    * there are no active subscriptions by other federates.
    * This occurs only if the federate's Interaction Relevance
Advisory Switch is turned on.
    * @param theHandle the {@link InteractionClassHandle} of the
subject interaction class
    * @throws InteractionClassNotPublished should be thrown if the
federate denies publishing <code>theHandle</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnInteractionsOn turnInteractionsOn
    * @see RTIambassador#enableInteractionRelevanceAdvisorySwitch
enableInteractionRelevanceAdvisorySwitch
    * @see RTIambassador#disableInteractionRelevanceAdvisorySwitch
disableInteractionRelevanceAdvisorySwitch
    */
   public void
   turnInteractionsOff(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError;
}
//end FederateAmbassadorInteractionAdvisory
```

The `FederateAmbassadorNameReservation` interface is the `FederateAmbassador` part devoted to the name reservation outcome callbacks.

```
// File: FederateAmbassadorNameReservation.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Name Reservation callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorNameReservation
{
   ////////////////////////////////////////////////
   // Object Management Services - Name Reservation
   ////////////////////////////////////////////////

   // 6.3
   /**
    * Notifies the federate that the <code>objectName</code> provided
in a previous invocation of the
    * {@link RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName} method has been reserved.
    * <p>
    * DoD Interpretations of IEEE 1516-2000v2 changes the service name
from "<code>objectInstanceNameReservationSucceded</code>"
    * to "<code>objectInstanceNameReservationSucceeded</code>".
    * @param objectName a {@link java.lang.String} holding the
requested object name
    * @throws UnknownName should be thrown if the federate denies
requesting to reserve the <code>objectName</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName
    * @see #objectInstanceNameReservationFailed
objectInstanceNameReservationFailed
    */
   public void
   objectInstanceNameReservationSucceeded(
      String objectName)
   throws UnknownName,
          FederateInternalError;
   /**
    * Notifies the federate that the <code>objectName</code> provided
in a previous invocation of the
    * {@link RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName} method could not be reserved.
    * @param objectName a {@link java.lang.String} holding the
requested object name
    * @throws UnknownName should be thrown if the federate denies
requesting to reserve the <code>objectName</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName
    * @see #objectInstanceNameReservationSucceeded
objectInstanceNameReservationSucceeded
    */
   public void
   objectInstanceNameReservationFailed(
      String objectName)
   throws UnknownName,
          FederateInternalError;
}
//end FederateAmbassadorNameReservation
```

The `FederateAmbassadorObjectDiscovery` interface is the `FederateAmbassador` part devoted to the object discovery callbacks.

```
// File: FederateAmbassadorObjectDiscovery.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Object Discovery callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorObjectDiscovery
{
   ///////////////////////////////////////////////////
   // Object Management Services - Object Discovery
   ///////////////////////////////////////////////////

   // 6.5
   /**
    * Notifies the federate that it has discovered an object instance.
    * @param theObject the {@link ObjectInstanceHandle} of the newly
discovered object instance
    * @param theObjectClass the {@link ObjectClassHandle} of the class
the instance was discovered as
    * @param objectName a {@link java.lang.String} holding the newly
discovered object instance's name
    * @throws CouldNotDiscover should be thrown if the object instance
could not be discovered for some reason other than an unrecognized
object class
    * @throws ObjectClassNotRecognized should be thrown if the
federate does not recognize <code>theObjectClass</code>
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#registerObjectInstance registerObjectInstance
    */
   public void
   discoverObjectInstance(
      ObjectInstanceHandle theObject,
      ObjectClassHandle    theObjectClass,
      String               objectName)
   throws CouldNotDiscover,
          ObjectClassNotRecognized,
          FederateInternalError;
}
//end FederateAmbassadorObjectDiscovery
```

The `FederateAmbassadorAttributeUpdateClient` interface is the `FederateAmbassador` part devoted to the client (subscriber) object instance attribute updates.

```
// File: FederateAmbassadorAttributeUpdateClient.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Instance Attribute Update (Receive) callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorAttributeUpdateClient
{
   ////////////////////////////////////////////////////////////////
   // Object Management Services - Instance Attribute Update (Receive)
   ////////////////////////////////////////////////////////////////

   // 6.7
   /**
    * Provides the federate with new values for the specified instance
attributes.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[])
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes
    * and specifies the update regions used.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided,
    * the instance attributes have available dimensions, the
federate's Convey Region
    * Designator Sets Switch is enabled and an update region set was
used by the sender.
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link InvalidRegion} or
{@link InvalidRegionContext}
    * exceptions (nor a notional new <code>InvalidRegionSet</code>
exception); in other words the RTI
    * guarantees the validity and pertinence of the supplied
<code>sentOrdering</code>,
    * <code>theTransport</code> and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param sentRegions the {@link RegionHandleSet} used to send the
update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[])
    * @see RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes
    * and specifies the time-stamp at which this comes into effect.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * a time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the <code>receivedOrdering</code> is also
RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link InvalidLogicalTime}
    * exceptions; in other words the RTI guarantees the validity of
the supplied
    * <code>sentOrdering</code>, <code>theTransport</code>,
<code>theTime</code>
    * and <code>receivedOrdering</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes,
    * specifies the update regions used
    * and specifies the time-stamp at which this comes into effect.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * a time-stamp was provided,
    * the instance attributes have available dimensions, the
federate's
    * Convey Region Designator Sets Switch is enabled and an update
region set
    * was used by the sender.
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the <code>receivedOrdering</code> is also
RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link InvalidLogicalTime},
{@link InvalidRegion} or
    * {@link InvalidRegionContext} exceptions (nor a notional new
<code>InvalidRegionSet</code>
    * exception); in other words the RTI guarantees the validity of
the supplied
    * <code>sentOrdering</code>, <code>theTransport</code>,
<code>theTime</code>,
    * <code>receivedOrdering</code> and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param sentRegions the {@link RegionHandleSet} used to send the
update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    * @see RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes
    * and specifies the time-stamp at which this comes into effect as
well as a retraction handle.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (thus a time-stamp was provided)
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link
InvalidMessageRetractionHandle} exceptions;
    * in other words the RTI guarantees the validity of the supplied
    * <code>sentOrdering</code>, <code>theTransport</code>,
<code>receivedOrdering</code> and
    * <code>retractionHandle</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
   /**
    * Provides the federate with new values for the specified instance
attributes,
    * specifies the update regions used
    * and specifies the time-stamp at which this comes into effect as
well as a retraction handle.
    * This callback, coupled with the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method,
    * forms the primary data exchange mechanism supported by the RTI.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (thus a time-stamp was provided),
    * the instance attributes have available dimensions, the
federate's Convey Region Designator Sets Switch
    * is enabled and an update region set was used by the sender.
    * <p>
    * Note that the
    * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link
InvalidMessageRetractionHandle},
    * {@link InvalidRegion} or {@link InvalidRegionContext} exceptions
(nor a notional
    * new <code>InvalidRegionSet</code> exception); in other words the
RTI guarantees the validity
    * of the supplied <code>sentOrdering</code>,
<code>theTransport</code>, <code>receivedOrdering</code>,
    * <code>retractionHandle</code> and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @param sentRegions the {@link RegionHandleSet} used to send the
update
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#updateAttributeValues(ObjectInstanceHandle,AttributeHand
leValueMap,byte[],LogicalTime)
    * @see RTIambassador#associateRegionsForUpdates
associateRegionsForUpdates
    */
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
}
//end FederateAmbassadorAttributeUpdateClient
```

The `FederateAmbassadorInteractionOccurrence` interface is the `FederateAmbassador` part devoted to interaction occurrence reception.

```
// File: FederateAmbassadorInteractionOccurrence.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Interaction Update callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorInteractionOccurrence
{
   ////////////////////////////////////////////////////
   // Object Management Services - Interaction Update
   ////////////////////////////////////////////////////

   // 6.9
   /**
    * Provides the federate with a sent interaction.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleVa
lueMap,byte[])
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction and
    * specifies the broadcasting regions used.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * no time-stamp was provided,
    * the parameters have available dimensions, the federate's Convey
Region
    * Designator Sets Switch is enabled and an update region set was
used by the sender.
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link InvalidRegion} or
{@link InvalidRegionContext} exceptions
    * (nor a notional new <code>InvalidRegionSet</code> exception); in
other words the RTI guarantees
    * the validity of the supplied <code>sentOrdering</code>,
<code>theTransport</code>
    * and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param sentRegions the {@link RegionHandleSet} used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteractionWithRegions(InteractionClassHandle,Parame
terHandleValueMap,RegionHandleSet,byte[])
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction
    * and specifies the time-stamp at which this occurs.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * a time-stamp was provided
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link InvalidLogicalTime}
exceptions; in other words the
    * RTI guarantees the validity of the supplied
<code>sentOrdering</code>, <code>theTransport</code>,
    * <code>receivedOrdering</code> and <code>theTime</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleVa
lueMap,byte[],LogicalTime)
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction,
    * specifies the broadcasting regions used
    * and specifies the time-stamp at which this occurs.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE,
    * a time-stamp was provided,
    * the parameters have available dimensions, the federate's Convey
Region
    * Designator Sets Switch is enabled and an update region set was
used by the sender.
    * <p>
    * Note that the
    * absence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is RECEIVE
    * (and that therefore the received ordering is also RECEIVE).
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType}, {@link InvalidLogicalTime},
{@link InvalidRegion} or
    * {@link InvalidRegionContext} exceptions (nor a notional new
<code>InvalidRegionSet</code> exception);
    * in other words the RTI guarantees the validity of the supplied
<code>sentOrdering</code>,
    * <code>theTransport</code>, <code>receivedOrdering</code>,
<code>theTime</code>
    * and <code>sentRegions</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param sentRegions the {@link RegionHandleSet} used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteractionWithRegions(InteractionClassHandle,Parame
terHandleValueMap,RegionHandleSet,byte[],LogicalTime)
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError;
   /**
    * Provides the federate with a sent interaction
    * and specifies the time-stamp at which this occurs as well as a
retraction handle.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (thus a time-stamp was provided)
    * and an update region set was not used by the sender (or is not
pertinent or is
    * being filtered out by the receiver).
    * <p>
    * Note that the
    * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
    * <p>
    * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
    * {@link InvalidTransportationType} exceptions; in other words the
RTI
    * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
    * Note that the federate is not expected to throw the {@link
InvalidOrderType},
    * {@link InvalidTransportationType} or {@link
InvalidMessageRetractionHandle} exceptions;
    * in other words the RTI guarantees the validity of the supplied
<code>sentOrdering</code>,
    * <code>theTransport</code>, <code>receivedOrdering</code> and
<code>messageRetractionHandle</code>.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param messageRetractionHandle the {@link
MessageRetractionHandle} of the message
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see
RTIambassador#sendInteraction(InteractionClassHandle,ParameterHandleVa
lueMap,byte[],LogicalTime)
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
    /**
     * Provides the federate with a sent interaction,
     * specifies the broadcasting regions used
     * and specifies the time-stamp at which this occurs as well as a
retraction handle.
     * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
     * (thus a time-stamp was provided),
     * the parameters have available dimensions, the federate's Convey
Region
     * Designator Sets Switch is enabled and an update region set was
used by the sender.
     * <p>
     * Note that the
     * presence of a {@link MessageRetractionHandle} implies the
<code>sentOrdering</code> is TIMESTAMP.
     * <p>
     * Note that the federate is not expected to throw the {@link
InvalidOrderType} or
     * {@link InvalidTransportationType} exceptions; in other words the
RTI
     * guarantees the validity of the supplied
<code>sentOrdering</code> and <code>theTransport</code>.
     * Note that the federate is not expected to throw the {@link
InvalidOrderType},
     * {@link InvalidTransportationType}, {@link
InvalidMessageRetractionHandle},
     * {@link InvalidRegion} or {@link InvalidRegionContext} exceptions
(nor a notional
     * new <code>InvalidRegionSet</code> exception); in other words the
RTI guarantees the validity
     * of the supplied <code>sentOrdering</code>,
<code>theTransport</code>, <code>receivedOrdering</code>,
     * <code>messageRetractionHandle</code> and
<code>sentRegions</code>.
     * <p>
     * The time stamp and receive message order type arguments are
supplied together or not at all,
     * which explains the absence of some other possible forms of this
callback.
```

```
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param messageRetractionHandle the {@link
MessageRetractionHandle} of the message
    * @param sentRegions the {@link RegionHandleSet} used to send the
interaction
    * @throws InteractionClassNotRecognized should be thrown if the
federate does not recognize the interaction class
    * @throws InteractionParameterNotRecognized should be thrown if
one of the supplied parameters isn't recognized in the supplied
context
    * @throws InteractionClassNotSubscribed should be thrown if the
federate denies subscribing to the interaction
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#sendInteractionWithRegions
sendInteractionWithRegions
    */
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError;
}
//end FederateAmbassadorInteractionOccurrence
```

The `FederateAmbassadorObjectRemoval` interface is the `FederateAmbassador` part devoted to the object instance removal callbacks.

```
// File: FederateAmbassadorObjectRemoval.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Object Removal callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorObjectRemoval
{
   ////////////////////////////////////////////////
   // Object Management Services - Object Removal
   ////////////////////////////////////////////////

   // 6.11
   /**
    * Notifies the federate that an object instance has been deleted
from the federation execution.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE
    * and no time-stamp was provided.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the message was sent
as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#deleteObjectInstance deleteObjectInstance
    */
   public void
   removeObjectInstance(
      ObjectInstanceHandle theObject,
      byte[]               userSuppliedTag,
      OrderType            sentOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError;
   /**
    * Notifies the federate that an object instance has been deleted
from the federation execution
    * at the specified time stamp.
    * This form is invoked by the RTI only if the sent order type was
RECEIVE
    * and a time-stamp was provided.
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the message was sent
as
    * @param theTime the {@link LogicalTime} at which the deletion
occurs
    * @param receivedOrdering the {@link OrderType} the message was
received as
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#deleteObjectInstance deleteObjectInstance
    */
   public void
   removeObjectInstance(
   ObjectInstanceHandle theObject,
      byte[]            userSuppliedTag,
      OrderType         sentOrdering,
      LogicalTime       theTime,
      OrderType         receivedOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError;
   /**
    * Notifies the federate that an object instance has been deleted
from the federation execution
    * at the specified time stamp and specifies a retraction handle.
    * This form is invoked by the RTI only if the sent order type was
TIMESTAMP
    * (and thus a time-stamp was provided).
    * <p>
    * The time stamp and receive message order type arguments are
supplied together or not at all,
    * which explains the absence of some other possible forms of this
callback.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the message was sent
as
    * @param theTime the {@link LogicalTime} at which the deletion
occurs
    * @param receivedOrdering the {@link OrderType} the message was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid (only if the
<code>receivedOrdering</code> is TIMESTAMP)
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#deleteObjectInstance deleteObjectInstance
    */
   public void
   removeObjectInstance(
      ObjectInstanceHandle    theObject,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          InvalidLogicalTime,
          FederateInternalError;
}
//end FederateAmbassadorObjectRemoval
```

The `FederateAmbassadorAttributeScopeAdvisoryClient` interface is the `FederateAmbassador` part devoted to the client (subscriber) object instance attribute scope advisories.

```
// File: FederateAmbassadorAttributeScopeAdvisoryClient.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Instance Attribute Scope Advisory callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorAttributeScopeAdvisoryClient
{
   ///////////////////////////////////////////////////////////////////
   // Object Management Services - Instance Attribute Scope Advisory
(Receive)
   ///////////////////////////////////////////////////////////////////

   // 6.15
   /**
    * Notifies the federate that the specified attributes for the
object instance are in its scope.
    * This occurs only if the Attribute Scope Advisory Switch is on
for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the pertinent attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #attributesOutOfScope attributesOutOfScope
    * @see RTIambassador#enableAttributeScopeAdvisorySwitch
enableAttributeScopeAdvisorySwitch
    * @see RTIambassador#disableAttributeScopeAdvisorySwitch
disableAttributeScopeAdvisorySwitch
    */
   public void
   attributesInScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
   // 6.16
   /**
    * Notifies the federate that the specified attributes for the
object instance are out of its scope.
    * This occurs only if the Attribute Scope Advisory Switch is on
for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the pertinent attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotSubscribed should be thrown if the federate
denies subscribing to one of the attributes
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #attributesInScope attributesInScope
    * @see RTIambassador#enableAttributeScopeAdvisorySwitch
enableAttributeScopeAdvisorySwitch
    * @see RTIambassador#disableAttributeScopeAdvisorySwitch
disableAttributeScopeAdvisorySwitch
    */
   public void
   attributesOutOfScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError;
}
//end FederateAmbassadorAttributeScopeAdvisoryClient
```

The `FederateAmbassadorAttributeUpdateServer` interface is the `FederateAmbassador` part devoted to the server (publisher) object instance attribute update request callback.

```
// File: FederateAmbassadorAttributeUpdateServer.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Instance Attribute Update (Send) callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorAttributeUpdateServer
{
   ////////////////////////////////////////////////////////////////
   // Object Management Services - Instance Attribute Update (Send)
   ////////////////////////////////////////////////////////////////

   // 6.18
   /**
    * Requests of the federate the current values of the specified
instance attributes, which it owns.
    * The federate should respond through the {@link
RTIambassador#updateAttributeValues updateAttributeValues} method.
    * @param theObject the {@link ObjectInstanceHandle} of the subject
object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the requested attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#requestAttributeValueUpdate
requestAttributeValueUpdate
    */
   public void
   provideAttributeValueUpdate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
}
//end FederateAmbassadorAttributeUpdateServer
```

The `FederateAmbassadorAttributeScopeAdvisoryServer` interface is the `FederateAmbassador` part devoted to the server (publisher) object instance attribute scope advisories.

```
// File: FederateAmbassadorAttributeScopeAdvisoryServer.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Instance Attribute Scope Advisory (Send) callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorAttributeScopeAdvisoryServer
{
   ///////////////////////////////////////////////////////////////////
   // Object Management Services - Instance Attribute Scope Advisory
(Send)
   ///////////////////////////////////////////////////////////////////

   // 6.19
   /**
    * Indicates to the federate that the values of the specified
instance attributes are required somewhere
    * in the federation execution. The federate should therefore
update them as needed.
    * This occurs only if the Attribute Relevance Advisory Switch is
on for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the subject
object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnUpdatesOffForObjectInstance
turnUpdatesOffForObjectInstance
    * @see RTIambassador#enableAttributeRelevanceAdvisorySwitch
enableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#disableAttributeRelevanceAdvisorySwitch
disableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#updateAttributeValues updateAttributeValues
    */
   public void
   turnUpdatesOnForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
   // 6.20
   /**
    * Indicates to the federate that the values of the specified
instance attributes are no
    * longer required anywhere in the federation execution.
    * This occurs only if the Attribute Relevance Advisory Switch is
on for the federate.
    * @param theObject the {@link ObjectInstanceHandle} of the subject
object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see #turnUpdatesOnForObjectInstance
turnUpdatesOnForObjectInstance
    * @see RTIambassador#enableAttributeRelevanceAdvisorySwitch
enableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#disableAttributeRelevanceAdvisorySwitch
disableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#updateAttributeValues updateAttributeValues
    */
   public void
   turnUpdatesOffForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
}
//end FederateAmbassadorAttributeScopeAdvisoryServer
```

The `FederateAmbassadorAttributeOwnership` interface is the `FederateAmbassador` part devoted to object ownership management.

```
// File: FederateAmbassadorAttributeOwnership.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Instance Attribute Ownership callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorAttributeOwnership
{
   ////////////////////////////////
   // Ownership Management Services
   ////////////////////////////////

   // 7.4
   /**
    * Requests that the federate acquire ownership of the specified
instance attributes.
    * This can occur because the original owner invoked {@link
RTIambassador#unconditionalAttributeOwnershipDivestiture
unconditionalAttributeOwnershipDivestiture},
    * {@link RTIambassador#unpublishObjectClassAttributes
unpublishObjectClassAttributes} or {@link
RTIambassador#resignFederationExecution resignFederationExecution}
(with
    * the UNCONDITIONALLY_DIVEST_ATTRIBUTES,
DELETE_OBJECTS_THEN_DIVEST or CANCEL_THEN_DELETE_THEN_DIVEST policy).
    * <p>
    * The federate may return a subset of the
<code>offeredAttributes</code> for which it is willing to assume
ownership
    * through the {@link RTIambassador#attributeOwnershipAcquisition
attributeOwnershipAcquisition} or {@link
RTIambassador#attributeOwnershipAcquisitionIfAvailable
attributeOwnershipAcquisitionIfAvailable}
    * methods.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param offeredAttributes an {@link AttributeHandleSet}
specifying the offered attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeNotPublished should be thrown if the federate
denies publishing an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   requestAttributeOwnershipAssumption(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError;
   // 7.5
   /**
    * Notifies the federate that potential new owners have been found
for the specified instance attributes and that
    * the negotiated divestiture of these can now be completed. The
federate can either complete the negotiated
    * divestiture using {@link RTIambassador#confirmDivestiture
confirmDivestiture}, divest ownership of the instance attributes by
    * some other means (e.g., using {@link
RTIambassador#unconditionalAttributeOwnershipDivestiture
unconditionalAttributeOwnershipDivestiture}) or it can
    * {@link
RTIambassador#cancelNegotiatedAttributeOwnershipDivestiture
cancelNegotiatedAttributeOwnershipDivestiture}.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param offeredAttributes an {@link AttributeHandleSet}
specifying the offered attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws AttributeDivestitureWasNotRequested should be thrown if
the federate repudiates the divestiture
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   requestDivestitureConfirmation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          AttributeDivestitureWasNotRequested,
          FederateInternalError;
   // 7.7
   /**
    * Notifies the federate that it now owns the specified set of
instance attributes.
    * The federate may receive multiple notifications for a single
invocation of
    * {@link RTIambassador#attributeOwnershipAcquisition
attributeOwnershipAcquisition} or
    * {@link RTIambassador#attributeOwnershipAcquisitionIfAvailable
attributeOwnershipAcquisitionIfAvailable} if the requested
    * instance attributes are owned by different federates.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param securedAttributes an {@link AttributeHandleSet}
specifying the secured attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAcquisitionWasNotRequested should be thrown if
the federate repudiates its attribute ownership acquisition request
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeNotPublished should be thrown if the federate
denies publishing an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    */
   public void
   attributeOwnershipAcquisitionNotification(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   securedAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAcquisitionWasNotRequested,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError;
   // 7.10
   /**
    * Notifies the federate that the specified instance attributes
were not available for ownership acquisition.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the declined attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeAcquisitionWasNotRequested should be thrown if
the federate repudiates its attribute ownership acquisition request
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#attributeOwnershipAcquisitionIfAvailable
attributeOwnershipAcquisitionIfAvailable
    */
   public void
   attributeOwnershipUnavailable(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotRequested,
          FederateInternalError;
   // 7.11
   /**
    * Requests that the federate release ownership of the specified
instance attributes.
    * The federate may return the subset of instance attributes for
which it is willing
    * to release ownership through {@link
RTIambassador#attributeOwnershipDivestitureIfWanted
attributeOwnershipDivestitureIfWanted},
    * {@link RTIambassador#unconditionalAttributeOwnershipDivestiture
unconditionalAttributeOwnershipDivestiture} or
    * {@link RTIambassador#negotiatedAttributeOwnershipDivestiture
negotiatedAttributeOwnershipDivestiture}.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param candidateAttributes an {@link AttributeHandleSet}
specifying the candidate attributes
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeNotOwned should be thrown if the federate
denies owning an attribute
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#attributeOwnershipAcquisition
attributeOwnershipAcquisition
    */
   public void
   requestAttributeOwnershipRelease(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   candidateAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError;
   // 7.15
   /**
    * Notifies the federate that the pending attribute ownership
acquisition requests for the
    * specified instance attributes have been canceled as requested.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws AttributeAlreadyOwned should be thrown if the federate
thinks it already owns an attribute
    * @throws AttributeAcquisitionWasNotCanceled should be thrown if
the federate repudiates the attribute ownership acquisition
cancellation
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#cancelAttributeOwnershipAcquisition
cancelAttributeOwnershipAcquisition
    */
   public void
   confirmAttributeOwnershipAcquisitionCancellation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotCanceled,
          FederateInternalError;
   // 7.17
   /**
    * In response to an attribute ownership query by the federate,
specifies the instance attribute's owner: another federate.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttribute an {@link AttributeHandle} specifying the
attribute
    * @param theOwner the {@link FederateHandle} of the federate
owning the attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#queryAttributeOwnership
queryAttributeOwnership
    */
   public void
   informAttributeOwnership(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute,
      FederateHandle       theOwner)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;

   /**
    * In response to an attribute ownership query by the federate,
specifies that the instance attribute is unowned.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttribute an {@link AttributeHandle} specifying the
attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#queryAttributeOwnership
queryAttributeOwnership
    */
   public void
   attributeIsNotOwned(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;
   /**
    * In response to an attribute ownership query by the federate,
specifies the instance attribute's owner: the RTI.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttribute an {@link AttributeHandle} specifying the
attribute
    * @throws ObjectInstanceNotKnown should be thrown if the federate
denies having previously discovered the object instance
    * @throws AttributeNotRecognized should be thrown if one of the
supplied attributes isn't recognized in the supplied context
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#queryAttributeOwnership
queryAttributeOwnership
    */
   public void
   attributeIsOwnedByRTI(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError;
}
//end FederateAmbassadorAttributeOwnership
```

The `FederateAmbassadorTime` interface is the `FederateAmbassador` part devoted to the time management callbacks.

```
// File: FederateAmbassadorTime.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A subset of the hla.rti1516.FederateAmbassador interface that
contains only the Time callbacks.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public interface FederateAmbassadorTime
{
   ///////////////////////////////
   // Time Management Services //
   ///////////////////////////////

   // 8.3
   /**
    * Notifies the federate that its request to enable time-regulation
has been honored.
    * @param time the {@link LogicalTime} to which the federate's
clock has been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws NoRequestToEnableTimeRegulationWasPending should be
thrown if the federate repudiates the time regulation request
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#enableTimeRegulation enableTimeRegulation
    */
   public void
   timeRegulationEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeRegulationWasPending,
          FederateInternalError;
   // 8.6
   /**
    * Notifies the federate that its request to enable time-constraint
has been honored.
    * @param time the {@link LogicalTime} to which the federate's
clock has been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws NoRequestToEnableTimeConstrainedWasPending should be
thrown if the federate repudiates the time constraint request
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#enableTimeConstrained enableTimeConstrained
    */
   public void
   timeConstrainedEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeConstrainedWasPending,
          FederateInternalError;

   // 8.13
   /**
    * Notifies the federate that its request to advance its logical
time has been honored.
    * @param theTime the {@link LogicalTime} to which the federate's
clock has been set
    * @throws InvalidLogicalTime should be thrown if the specified
<code>LogicalTime</code> is invalid
    * @throws JoinedFederateIsNotInTimeAdvancingState should be thrown
if the federate does not consider itself in the time-advancing state
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#timeAdvanceRequest timeAdvanceRequest
    * @see RTIambassador#timeAdvanceRequestAvailable
timeAdvanceRequestAvailable
    * @see RTIambassador#nextMessageRequest nextMessageRequest
    * @see RTIambassador#nextMessageRequestAvailable
nextMessageRequestAvailable
    * @see RTIambassador#flushQueueRequest flushQueueRequest
    */
   public void
   timeAdvanceGrant(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          JoinedFederateIsNotInTimeAdvancingState,
          FederateInternalError;
   // 8.22
   /**
    * Notifies the federate that the previously delivered message
specified by the supplied
    * {@link MessageRetractionHandle} has been retracted.
    * <p>
    * Time-constrained federates that do not use the {@link
RTIambassador#flushQueueRequest flushQueueRequest} method
    * are not subject to invocation of this service because they will
never receive a
    * {@link OrderType TIMESTAMP} message eligible for retraction.
    * Non-constrained federates, however, must be prepared to deal
with invocations of this
    * service because any received message that was sent {@link
OrderType TIMESTAMP} may be eligible for retraction.
    * @param theHandle the {@link MessageRetractionHandle} specifying
the retracted message
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#retract retract
    */
   public void
   requestRetraction(
      MessageRetractionHandle theHandle)
   throws FederateInternalError;
}
//end FederateAmbassadorTime
```

The FedAmbAttributeScopeAdvisoryListener class implements the FederateAmbassadorAttributeScopeAdvisoryClient interface. It funnels both callbacks to a single method, doScope (by appending a Boolean argument), allowing the programmer to either override the latter or the individual FederateAmbassador attributesIn/OutOfScope methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to doScope.

```
// File: FedAmbAttributeScopeAdvisoryListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of
FederateAmbassadorAttributeScopeAdvisoryClient interface.
 * This implementation funnels both callbacks to the doScope method,
 * so you can either override the attributesIn/OutOfScope methods or
doScope.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbAttributeScopeAdvisoryListener
   implements FederateAmbassadorAttributeScopeAdvisoryClient
{
   /**
    * The ValidateAttributesInScope validation interface.
    */
   public ValidateAttributesInScope
   attributesInScopeValidator;

   /**
    * The ValidateAttributesOutOfScope validation interface.
    */
   public ValidateAttributesOutOfScope
   attributesOutOfScopeValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbAttributeScopeAdvisoryListener()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param attributesInScope_Validator A ValidateAttributesInScope
interface
    * @param attributesOutOfScope_Validator A
ValidateAttributesOutOfScope interface
    */
   public
   FedAmbAttributeScopeAdvisoryListener(
      ValidateAttributesInScope    attributesInScope_Validator,
      ValidateAttributesOutOfScope attributesOutOfScope_Validator)
   {
//    this();
      attributesInScopeValidator    = attributesInScope_Validator;
      attributesOutOfScopeValidator = attributesOutOfScope_Validator;
   }

   //FederateAmbassadorAttributeScopeAdvisoryClient implementation

   public void
   attributesInScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      if (null != attributesInScopeValidator)
attributesInScopeValidator.validate(theObject, theAttributes);
      doScope(theObject, theAttributes, true);
   }

   public void
   attributesOutOfScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      if (null != attributesOutOfScopeValidator)
attributesOutOfScopeValidator.validate(theObject, theAttributes);
      doScope(theObject, theAttributes, false);
   }
   /**
    * This implementation simply funnels both callbacks to this
method,
    * so you can either override the attributesIn/OutOfScope methods
or this one.
    * Validation is handled by the callbacks.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the pertinent attributes
    * @param inScope a boolean indicating whether the specified
attributes are in or out of scope
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see FederateAmbassador#attributesInScope attributesInScope
    * @see FederateAmbassador#attributesOutOfScope
attributesOutOfScope
    * @see RTIambassador#enableAttributeScopeAdvisorySwitch
enableAttributeScopeAdvisorySwitch
    * @see RTIambassador#disableAttributeScopeAdvisorySwitch
disableAttributeScopeAdvisorySwitch
    */
   protected void
   doScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      boolean              inScope)
   throws FederateInternalError
   {
   }
}
//end FedAmbAttributeScopeAdvisoryListener
```

The `FedAmbAttributeScopeAdvisoryResponder` class implements the `FederateAmbassadorAttributeScopeAdvisoryServer` interface. It funnels both callbacks to a single method, `doScope` (by appending a Boolean argument), allowing the programmer to either override the latter or the individual `FederateAmbassador` `turnUpdatesOn/OffForObjectInstance` methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to `doScope`.

```
// File: FedAmbAttributeScopeAdvisoryResponder.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of
FederateAmbassadorAttributeScopeAdvisoryServer interface.
 * This implementation funnels both callbacks to the doScope method,
 * so you can either override the turnUpdatesOn/OffForObjectInstance
methods or doScope.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbAttributeScopeAdvisoryResponder
   implements FederateAmbassadorAttributeScopeAdvisoryServer
{
   /**
    * The ValidateTurnUpdatesOnForObjectInstance validation interface.
    */
   public ValidateTurnUpdatesOnForObjectInstance
   turnUpdatesOnForObjectInstanceValidator;

   /**
    * The ValidateTurnUpdatesOffForObjectInstance validation
interface.
    */
   public ValidateTurnUpdatesOffForObjectInstance
   turnUpdatesOffForObjectInstanceValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbAttributeScopeAdvisoryResponder()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param turnUpdatesOnForObjectInstance_Validator A
ValidateTurnUpdatesOnForObjectInstance interface
    * @param turnUpdatesOffForObjectInstance_Validator A
ValidateTurnUpdatesOffForObjectInstance interface
    */
   public
   FedAmbAttributeScopeAdvisoryResponder(
      ValidateTurnUpdatesOnForObjectInstance
turnUpdatesOnForObjectInstance_Validator,
      ValidateTurnUpdatesOffForObjectInstance
turnUpdatesOffForObjectInstance_Validator)
   {
//    this();
      turnUpdatesOnForObjectInstanceValidator  =
turnUpdatesOnForObjectInstance_Validator;
      turnUpdatesOffForObjectInstanceValidator =
turnUpdatesOffForObjectInstance_Validator;
   }

   //FederateAmbassadorAttributeScopeAdvisoryServer implementation

   public void
   turnUpdatesOnForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      if (null != turnUpdatesOnForObjectInstanceValidator)
turnUpdatesOnForObjectInstanceValidator.validate(theObject,
theAttributes);
      doScope(theObject, theAttributes, true);
   }

   public void
   turnUpdatesOffForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      if (null != turnUpdatesOffForObjectInstanceValidator)
turnUpdatesOffForObjectInstanceValidator.validate(theObject,
theAttributes);
      doScope(theObject, theAttributes, false);
   }
   /**
    * This implementation simply funnels both callbacks to this
method,
    * so you can either override the
turnUpdatesOn/OffForObjectInstance methods or this one.
    * Validation is handled by the callbacks.
    * @param theObject the {@link ObjectInstanceHandle} of the subject
object instance
    * @param theAttributes an {@link AttributeHandleSet} specifying
the subject attributes
    * @param inScope a boolean indicating whether the updates should
be turned on or not
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#turnUpdatesOnForObjectInstance
turnUpdatesOnForObjectInstance
    * @see FederateAmbassador#turnUpdatesOffForObjectInstance
turnUpdatesOffForObjectInstance
    * @see RTIambassador#enableAttributeRelevanceAdvisorySwitch
enableAttributeRelevanceAdvisorySwitch
    * @see RTIambassador#disableAttributeRelevanceAdvisorySwitch
disableAttributeRelevanceAdvisorySwitch
    */
   protected void
   doScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      boolean              inScope)
   throws FederateInternalError
   {
   }
}
//end FedAmbAttributeScopeAdvisoryResponder
```

The FedAmbDiscoveryListener class implements the FederateAmbassadorObjectDiscovery interface. Being a null implementation, it does nothing with the callback.

The class has a public member holding the validation interface reference. The callback method invokes this if specified.

```
// File: FedAmbDiscoveryListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorObjectDiscovery interface.
 * The user should extend this class and override the
discoverObjectInstance method.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbDiscoveryListener
   implements FederateAmbassadorObjectDiscovery
{
   /**
    * The ValidateDiscoverObjectInstance validation interface.
    */
   public ValidateDiscoverObjectInstance
   discoverObjectInstanceValidator;

   /**
    * Default constructor. Creates an instance with no validator in
place.
    */
   public
   FedAmbDiscoveryListener()
   {
   }

   /**
    * Alternate constructor. Creates an instance with the specified
validator in place.
    * @param discoverObjectInstance_Validator A
ValidateDiscoverObjectInstance interface
    */
   public
   FedAmbDiscoveryListener(
      ValidateDiscoverObjectInstance discoverObjectInstance_Validator)
   {
//    this();
      discoverObjectInstanceValidator =
discoverObjectInstance_Validator;
   }
   //FederateAmbassadorObjectDiscovery implementation

   public void
   discoverObjectInstance(
      ObjectInstanceHandle theObject,
      ObjectClassHandle    theObjectClass,
      String               objectName)
   throws CouldNotDiscover,
          ObjectClassNotRecognized,
          FederateInternalError
   {
      if (null != discoverObjectInstanceValidator)
discoverObjectInstanceValidator.validate(theObject, theObjectClass,
objectName);
   }
}
//end FedAmbDiscoveryListener
```

The FedAmbInstanceAttributeListener class implements the FederateAmbassadorAttributeUpdateClient interface. It funnels all six forms of the callback to a single method, doUpdate (by supplying nulls for any missing arguments), allowing the programmer to either override the latter or the individual FederateAmbassador reflectAttributeValues methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has a public member holding the validation interface reference. The callback methods invoke this if specified, before handing off to doUpdate.

```
// File: FedAmbInstanceAttributeListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorAttributeUpdateClient
interface.
 * All of the reflectAttributeValues callbacks are funneled to the
doUpdate method,
 * so you can either override the relevant callback(s) or doUpdate.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbInstanceAttributeListener
   implements FederateAmbassadorAttributeUpdateClient
{
   /**
    * The ValidateReflectAttributeValues validation interface.
    */
   public ValidateReflectAttributeValues
   reflectAttributeValuesValidator;

   /**
    * Default constructor. Creates an instance with no validator in
place.
    */
   public
   FedAmbInstanceAttributeListener()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validator in place.
    * @param reflectAttributeValues_Validator A
ValidateReflectAttributeValues interface
    */
   public
   FedAmbInstanceAttributeListener(
      ValidateReflectAttributeValues reflectAttributeValues_Validator)
   {
//    this();
      reflectAttributeValuesValidator =
reflectAttributeValues_Validator;
   }

   //FederateAmbassadorAttributeUpdateClient implementation

   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      if (null != reflectAttributeValuesValidator)
reflectAttributeValuesValidator.validate(
         theObject, theAttributes, userSuppliedTag, sentOrdering,
theTransport);
      doUpdate(theObject, theAttributes, userSuppliedTag,
sentOrdering, theTransport, null, null, null, null);
   }

   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      if (null != reflectAttributeValuesValidator)
reflectAttributeValuesValidator.validate(
         theObject, theAttributes, userSuppliedTag, sentOrdering,
theTransport, sentRegions);
      doUpdate(theObject, theAttributes, userSuppliedTag,
sentOrdering, theTransport, null, null, null, sentRegions);
   }
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      if (null != reflectAttributeValuesValidator)
reflectAttributeValuesValidator.validate(
         theObject, theAttributes, userSuppliedTag, sentOrdering,
theTransport, theTime, receivedOrdering);
      doUpdate(theObject, theAttributes, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering, null, null);
   }

   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      if (null != reflectAttributeValuesValidator)
reflectAttributeValuesValidator.validate(
         theObject, theAttributes, userSuppliedTag, sentOrdering,
theTransport, theTime, receivedOrdering, sentRegions);
      doUpdate(theObject, theAttributes, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering, null,
sentRegions);
   }
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      if (null != reflectAttributeValuesValidator)
reflectAttributeValuesValidator.validate(
         theObject, theAttributes, userSuppliedTag, sentOrdering,
theTransport, theTime, receivedOrdering, retractionHandle);
      doUpdate(theObject, theAttributes, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering,
retractionHandle, null);
   }

   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      if (null != reflectAttributeValuesValidator)
reflectAttributeValuesValidator.validate(
         theObject, theAttributes, userSuppliedTag, sentOrdering,
theTransport, theTime, receivedOrdering, retractionHandle,
sentRegions);
      doUpdate(theObject, theAttributes, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering,
retractionHandle, sentRegions);
   }
   /**
    * This implementation simply funnels all reflectAttributeValues
callbacks to this method,
    * so you can either override the relevant method(s) or this one.
    * Missing arguments will be null.
    * Validation is handled by the callbacks.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param theAttributes an {@link AttributeHandleValueMap}
specifying the new attribute values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the passel was sent as
    * @param theTransport the {@link TransportationType} used to send
the passel
    * @param theTime the {@link LogicalTime} at which the update comes
into effect
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @param sentRegions the {@link RegionHandleSet} used to send the
update
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#reflectAttributeValues
reflectAttributeValues
    */
   protected void
   doUpdate(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle,
      RegionHandleSet         sentRegions)
   throws FederateInternalError
   {
   }
}
//end FedAmbInstanceAttributeListener
```

The FedAmbInstanceAttributeResponder class implements the FederateAmbassadorAttributeUpdateServer interface. Being a null implementation, it does nothing with the callback.

The class has a public member holding the validation interface reference. The callback method invokes this if specified.

```
// File: FedAmbInstanceAttributeResponder.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorAttributeUpdateServer
interface.
 * The user should extend this class and override the
provideValueUpdate method.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbInstanceAttributeResponder
   implements FederateAmbassadorAttributeUpdateServer
{
   /**
    * The ValidateProvideAttributeValueUpdate validation interface.
    */
   public ValidateProvideAttributeValueUpdate
   provideAttributeValueUpdateValidator;

   /**
    * Default constructor. Creates an instance with no validator in
place.
    */
   public
   FedAmbInstanceAttributeResponder()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validator in place.
    * @param provideAttributeValueUpdate_Validator A
ValidateProvideAttributeValueUpdate interface
    */
   public
   FedAmbInstanceAttributeResponder(
      ValidateProvideAttributeValueUpdate
provideAttributeValueUpdate_Validator)
   {
//    this();
      provideAttributeValueUpdateValidator =
provideAttributeValueUpdate_Validator;
   }

   //FederateAmbassadorAttributeUpdateServer implementation

   public void
   provideAttributeValueUpdate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      if (null != provideAttributeValueUpdateValidator)
provideAttributeValueUpdateValidator.validate(theObject,
theAttributes, userSuppliedTag);
   }
}
//end FedAmbInstanceAttributeResponder
```

The FedAmbInteractionAdvisoryResponder class implements the FederateAmbassadorInteractionAdvisory interface. It funnels both callbacks to a single method, doRelevance (by appending a Boolean argument), allowing the programmer to either override the latter or the individual FederateAmbassador turnInteractionOn/Off methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to doRelevance.

```
// File: FedAmbInteractionAdvisoryResponder.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorInteractionAdvisory
interface.
 * This implementation funnels both callbacks to the doRelevance
method,
 * so you can either override the turnInteractionsOn/Off methods or
doRelevance.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbInteractionAdvisoryResponder
   implements FederateAmbassadorInteractionAdvisory
{
   /**
    * The ValidateTurnInteractionsOn validation interface.
    */
   public ValidateTurnInteractionsOn
   turnInteractionsOnValidator;

   /**
    * The ValidateTurnInteractionsOff validation interface.
    */
   public ValidateTurnInteractionsOff
   turnInteractionsOffValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbInteractionAdvisoryResponder()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param turnInteractionsOn_Validator A ValidateTurnInteractionsOn
interface
    * @param turnInteractionsOff_Validator A
ValidateTurnInteractionsOff interface
    */
   public
   FedAmbInteractionAdvisoryResponder(
      ValidateTurnInteractionsOn  turnInteractionsOn_Validator,
      ValidateTurnInteractionsOff turnInteractionsOff_Validator)
   {
//    this();
      turnInteractionsOnValidator  = turnInteractionsOn_Validator;
      turnInteractionsOffValidator = turnInteractionsOff_Validator;
   }

   //FederateAmbassadorInteractionAdvisory implementation

   public void
   turnInteractionsOn(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError
   {
      if (null != turnInteractionsOnValidator)
turnInteractionsOnValidator.validate(theHandle);
      doRelevance(theHandle, true);
   }

   public void
   turnInteractionsOff(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError
   {
      if (null != turnInteractionsOffValidator)
turnInteractionsOffValidator.validate(theHandle);
      doRelevance(theHandle, false);
   }
   /**
    * This implementation simply funnels both callbacks to this
method,
    * so you can either override the turnInteractionsOn/Off methods or
this one.
    * Validation is handled by the callbacks.
    * @param theHandle the {@link InteractionClassHandle} of the
subject interaction class
    * @param relevant a boolean indicating whether the specified
interaction class is relevant or not
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#turnInteractionsOn turnInteractionsOn
    * @see FederateAmbassador#turnInteractionsOff turnInteractionsOff
    * @see RTIambassador#enableInteractionRelevanceAdvisorySwitch
enableInteractionRelevanceAdvisorySwitch
    * @see RTIambassador#disableInteractionRelevanceAdvisorySwitch
disableInteractionRelevanceAdvisorySwitch
    */
   protected void
   doRelevance(
      InteractionClassHandle theHandle,
      boolean                relevant)
   throws FederateInternalError
   {
   }
}
//end FedAmbInteractionAdvisoryResponder
```

The `FedAmbInteractionListener` class implements the `FederateAmbassadorInteractionOccurrence` interface. It funnels all six forms of the callback to a single method, `doInteraction` (by supplying nulls for any missing arguments), allowing the programmer to either override the latter or the individual `FederateAmbassador` `receiveInteraction` methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has a public member holding the validation interface reference. The callback methods invoke this if specified, before handing off to `doInteraction`.

```
// File: FedAmbInteractionListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorInteractionOccurrence
interface.
 * This implementation funnels all callbacks to the doInteraction
method,
 * so you can either override the relevant callback(s) or
doInteraction.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbInteractionListener
   implements FederateAmbassadorInteractionOccurrence
{
   /**
    * The ValidateReceiveInteraction validation interface.
    */
   public ValidateReceiveInteraction
   receiveInteractionValidator;

   /**
    * Default constructor. Creates an instance with no validator in
place.
    */
   public
   FedAmbInteractionListener()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validator in place.
    * @param receiveInteraction_Validator A ValidateReceiveInteraction
interface
    */
   public
   FedAmbInteractionListener(
      ValidateReceiveInteraction receiveInteraction_Validator)
   {
//    this();
      receiveInteractionValidator = receiveInteraction_Validator;
   }

   //FederateAmbassadorInteractionOccurrence implementation

   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      if (null != receiveInteractionValidator)
receiveInteractionValidator.validate(
         interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport);
      doInteraction(interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, null, null, null, null);
   }

   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      if (null != receiveInteractionValidator)
receiveInteractionValidator.validate(
         interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, sentRegions);
      doInteraction(interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, null, null, null, sentRegions);
   }
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      if (null != receiveInteractionValidator)
receiveInteractionValidator.validate(
         interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering);
      doInteraction(interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering, null, null);
   }

   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      if (null != receiveInteractionValidator)
receiveInteractionValidator.validate(
         interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering, sentRegions);
      doInteraction(interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering, null,
sentRegions);
   }
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      if (null != receiveInteractionValidator)
receiveInteractionValidator.validate(
         interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering,
messageRetractionHandle);
      doInteraction(interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering,
messageRetractionHandle, null);
   }

   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      if (null != receiveInteractionValidator)
receiveInteractionValidator.validate(
         interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering,
messageRetractionHandle, sentRegions);
      doInteraction(interactionClass, theParameters, userSuppliedTag,
sentOrdering, theTransport, theTime, receivedOrdering,
messageRetractionHandle, sentRegions);
   }
   /**
    * This implementation funnels all callbacks to the doInteraction
method,
    * so you can either override the relevant callback(s) or
doInteraction.
    * Missing arguments will be null.
    * Validation is handled by the callbacks.
    * @param interactionClass the {@link InteractionClassHandle} of
the received interaction
    * @param theParameters a {@link ParameterHandleValueMap}
specifying the interaction parameter values
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the interaction was
sent as
    * @param theTransport the {@link TransportationType} used to send
the interaction
    * @param theTime the {@link LogicalTime} at which the interaction
occurs
    * @param receivedOrdering the {@link OrderType} the passel was
received as
    * @param messageRetractionHandle the {@link
MessageRetractionHandle} of the message
    * @param sentRegions the {@link RegionHandleSet} used to send the
interaction
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#receiveInteraction receiveInteraction
    */
   protected void
   doInteraction(
         InteractionClassHandle  interactionClass,
         ParameterHandleValueMap theParameters,
         byte[]                  userSuppliedTag,
         OrderType               sentOrdering,
         TransportationType      theTransport,
         LogicalTime             theTime,
         OrderType               receivedOrdering,
         MessageRetractionHandle messageRetractionHandle,
         RegionHandleSet         sentRegions)
   throws FederateInternalError
   {
   }
}
//end FedAmbInteractionListener
```

The `FedAmbNameReservationListener` class implements the `FederateAmbassadorNameReservation` interface. It funnels both callbacks to a single method, `doReservation` (by appending a Boolean argument), allowing the programmer to either override the latter or the individual `FederateAmbassador objectInstanceNameReservationSucceeded/Failed` methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to `doReservation`.

```
// File: FedAmbNameReservationListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorNameReservation interface.
 * This implementation funnels both callbacks to the doReservation
method,
 * so you can either override the
objectInstanceNameReservationSucceeded/Failed methods or
doReservation.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbNameReservationListener
   implements FederateAmbassadorNameReservation
{
   /**
    * The ValidateObjectInstanceNameReservationSucceeded validation
interface.
    */
   public ValidateObjectInstanceNameReservationSucceeded
   objectInstanceNameReservationSucceededValidator;

   /**
    * The ValidateObjectInstanceNameReservationFailed validation
interface.
    */
   public ValidateObjectInstanceNameReservationFailed
   objectInstanceNameReservationFailedValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbNameReservationListener()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param objectInstanceNameReservationSucceeded_Validator A
ValidateObjectInstanceNameReservationSucceeded interface
    * @param objectInstanceNameReservationFailed_Validator A
ValidateObjectInstanceNameReservationFailed interface
    */
   public
   FedAmbNameReservationListener(
      ValidateObjectInstanceNameReservationSucceeded
objectInstanceNameReservationSucceeded_Validator,
      ValidateObjectInstanceNameReservationFailed
objectInstanceNameReservationFailed_Validator)
   {
//    this();
      objectInstanceNameReservationSucceededValidator =
objectInstanceNameReservationSucceeded_Validator;
      objectInstanceNameReservationFailedValidator    =
objectInstanceNameReservationFailed_Validator;
   }

   //FederateAmbassadorNameReservation implementation

   public void
   objectInstanceNameReservationSucceeded(
      String objectName)
   throws UnknownName,
          FederateInternalError
   {
      if (null != objectInstanceNameReservationSucceededValidator)
objectInstanceNameReservationSucceededValidator.validate(objectName);
      doReservation(objectName, true);
   }

   public void
   objectInstanceNameReservationFailed(
      String objectName)
   throws UnknownName,
          FederateInternalError
   {
      if (null != objectInstanceNameReservationFailedValidator)
objectInstanceNameReservationFailedValidator.validate(objectName);
      doReservation(objectName, false);
   }
   /**
    * This implementation simply funnels both callbacks to this
method,
    * so you can either override the
objectInstanceNameReservationSucceeded/Failed methods or this one.
    * Validation is handled by the callbacks.
    * @param objectName a {@link java.lang.String} holding the
requested object name
    * @param succeeded a boolean indicating whether the reservation
succeeded or not
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see RTIambassador#reserveObjectInstanceName
reserveObjectInstanceName
    * @see FederateAmbassador#objectInstanceNameReservationSucceeded
objectInstanceNameReservationSucceeded
    * @see FederateAmbassador#objectInstanceNameReservationFailed
objectInstanceNameReservationFailed
    */
   protected void
   doReservation(
      String  objectName,
      boolean succeeded)
   throws FederateInternalError
   {
   }
}
//end FedAmbNameReservationListener
```

The FedAmbObjectClassAdvisoryResponder class implements the FederateAmbassadorObjectRegistrationAdvisory interface. It funnels both callbacks to a single method, doRelevance (by appending a Boolean argument), allowing the programmer to either override the latter or the individual FederateAmbassador start/stopRegistrationForObjectClass methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to doRelevance.

```
// File: FedAmbObjectClassAdvisoryResponder.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorObjectRegistrationAdvisory
interface.
 * This implementation funnels both callbacks to the doRelevance
method,
 * so you can either override the start/stopRegistrationForObjectClass
methods or doRelevance.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbObjectClassAdvisoryResponder
   implements FederateAmbassadorObjectRegistrationAdvisory
{
   /**
    * The ValidateStartRegistrationForObjectClass validation
interface.
    */
   public ValidateStartRegistrationForObjectClass
   startRegistrationForObjectClassValidator;

   /**
    * The ValidateStopRegistrationForObjectClass validation interface.
    */
   public ValidateStopRegistrationForObjectClass
   stopRegistrationForObjectClassValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbObjectClassAdvisoryResponder()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param startRegistrationForObjectClass_Validator A
ValidateStartRegistrationForObjectClass interface
    * @param stopRegistrationForObjectClass_Validator A
ValidateStopRegistrationForObjectClass interface
    */
   public
   FedAmbObjectClassAdvisoryResponder(
      ValidateStartRegistrationForObjectClass
startRegistrationForObjectClass_Validator,
      ValidateStopRegistrationForObjectClass
stopRegistrationForObjectClass_Validator)
   {
//    this();
      startRegistrationForObjectClassValidator =
startRegistrationForObjectClass_Validator;
      stopRegistrationForObjectClassValidator  =
stopRegistrationForObjectClass_Validator;
   }

   //FederateAmbassadorObjectRegistrationAdvisory implementation

   public void
   startRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError
   {
      if (null != startRegistrationForObjectClassValidator)
startRegistrationForObjectClassValidator.validate(theClass);
      doRelevance(theClass, true);
   }

   public void
   stopRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError
   {
      if (null != stopRegistrationForObjectClassValidator)
stopRegistrationForObjectClassValidator.validate(theClass);
      doRelevance(theClass, false);
   }
   /**
    * This implementation simply funnels both callbacks to this
method,
    * so you can either override the
start/stopRegistrationForObjectClass methods or this one.
    * Validation is handled by the callbacks.
    * @param theClass the {@link ObjectClassHandle} of the subject
object class
    * @param relevant a boolean indicating whether the object class is
relevant or not
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#startRegistrationForObjectClass
startRegistrationForObjectClass
    * @see FederateAmbassador#stopRegistrationForObjectClass
stopRegistrationForObjectClass
    * @see RTIambassador#enableObjectClassRelevanceAdvisorySwitch
enableObjectClassRelevanceAdvisorySwitch
    * @see RTIambassador#disableObjectClassRelevanceAdvisorySwitch
disableObjectClassRelevanceAdvisorySwitch
    */
   protected void
   doRelevance(
      ObjectClassHandle theClass,
      boolean              relevant)
   throws FederateInternalError
   {
   }
}
//end FedAmbObjectClassAdvisoryResponder
```

The `FedAmbOwnershipListener` class implements the `FederateAmbassadorAttributeOwnership` interface. Of the nine callbacks, three (`informAttributeOwnership, attributeIsNotOwned,` and `attributeIsOwnedByRTI`) are funnelled to a single method, `doInformOwnership` (by appending a couple of Boolean arguments and supplying a null for an eventual missing argument), allowing the programmer to either override the latter or the individual `FederateAmbassador` methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to `doInformOwnership` (if applicable).

```
// File: FedAmbOwnershipListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A null implementation of the FederateAmbassadorAttributeOwnership
interface.
 * This implementation funnels the informAttributeOwnership,
attributeIsNotOwned
 * and attributeIsOwnedByRTI callbacks to the doInformOwnership
method,
 * so you can either override the relevant callback(s) or
doInformOwnership.
 * <p>
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbOwnershipListener
   implements FederateAmbassadorAttributeOwnership
{
   /**
    * The ValidateRequestAttributeOwnershipAssumption validation
interface.
    */
   public ValidateRequestAttributeOwnershipAssumption
   requestAttributeOwnershipAssumptionValidator;

   /**
    * The ValidateRequestDivestitureConfirmation validation interface.
    */
   public ValidateRequestDivestitureConfirmation
   requestDivestitureConfirmationValidator;
   /**
    * The ValidateAttributeOwnershipAcquisitionNotification validation
interface.
    */
   public ValidateAttributeOwnershipAcquisitionNotification
   attributeOwnershipAcquisitionNotificationValidator;

   /**
    * The ValidateAttributeOwnershipUnavailable validation interface.
    */
   public ValidateAttributeOwnershipUnavailable
   attributeOwnershipUnavailableValidator;

   /**
    * The ValidateRequestAttributeOwnershipRelease validation
interface.
    */
   public ValidateRequestAttributeOwnershipRelease
   requestAttributeOwnershipReleaseValidator;

   /**
    * The ValidateConfirmAttributeOwnershipAcquisitionCancellation
validation interface.
    */
   public ValidateConfirmAttributeOwnershipAcquisitionCancellation
   confirmAttributeOwnershipAcquisitionCancellationValidator;

   /**
    * The ValidateInformAttributeOwnership validation interface.
    */
   public ValidateInformAttributeOwnership
   informAttributeOwnershipValidator;

   /**
    * The ValidateAttributeIsNotOwned validation interface.
    */
   public ValidateAttributeIsNotOwned
   attributeIsNotOwnedValidator;

   /**
    * The ValidateAttributeIsOwnedByRTI validation interface.
    */
   public ValidateAttributeIsOwnedByRTI
   attributeIsOwnedByRTIValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbOwnershipListener()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param requestAttributeOwnershipAssumption_Validator A
ValidateRequestAttributeOwnershipAssumption interface
    * @param requestDivestitureConfirmation_Validator A
ValidateRequestDivestitureConfirmation interface
    * @param attributeOwnershipAcquisitionNotification_Validator A
ValidateAttributeOwnershipAcquisitionNotification interface
    * @param attributeOwnershipUnavailable_Validator A
ValidateAttributeOwnershipUnavailable interface
    * @param requestAttributeOwnershipRelease_Validator A
ValidateRequestAttributeOwnershipRelease interface
    * @param
confirmAttributeOwnershipAcquisitionCancellation_Validator A
ValidateConfirmAttributeOwnershipAcquisitionCancellation interface
    * @param informAttributeOwnership_Validator A
ValidateInformAttributeOwnership interface
    * @param attributeIsNotOwned_Validator A
ValidateAttributeIsNotOwned interface
    * @param attributeIsOwnedByRTI_Validator A
ValidateAttributeIsOwnedByRTI interface
    */
   public
   FedAmbOwnershipListener(
      ValidateRequestAttributeOwnershipAssumption
requestAttributeOwnershipAssumption_Validator,
      ValidateRequestDivestitureConfirmation
requestDivestitureConfirmation_Validator,
      ValidateAttributeOwnershipAcquisitionNotification
attributeOwnershipAcquisitionNotification_Validator,
      ValidateAttributeOwnershipUnavailable
attributeOwnershipUnavailable_Validator,
      ValidateRequestAttributeOwnershipRelease
requestAttributeOwnershipRelease_Validator,
      ValidateConfirmAttributeOwnershipAcquisitionCancellation
confirmAttributeOwnershipAcquisitionCancellation_Validator,
      ValidateInformAttributeOwnership
informAttributeOwnership_Validator,
      ValidateAttributeIsNotOwned
attributeIsNotOwned_Validator,
      ValidateAttributeIsOwnedByRTI
attributeIsOwnedByRTI_Validator)
   {
//    this();
      requestAttributeOwnershipAssumptionValidator              =
requestAttributeOwnershipAssumption_Validator;
      requestDivestitureConfirmationValidator                   =
requestDivestitureConfirmation_Validator;
      attributeOwnershipAcquisitionNotificationValidator        =
attributeOwnershipAcquisitionNotification_Validator;
      attributeOwnershipUnavailableValidator                    =
attributeOwnershipUnavailable_Validator;
      requestAttributeOwnershipReleaseValidator                 =
requestAttributeOwnershipRelease_Validator;
      confirmAttributeOwnershipAcquisitionCancellationValidator =
confirmAttributeOwnershipAcquisitionCancellation_Validator;
      informAttributeOwnershipValidator                         =
informAttributeOwnership_Validator;
      attributeIsNotOwnedValidator                              =
attributeIsNotOwned_Validator;
      attributeIsOwnedByRTIValidator                            =
attributeIsOwnedByRTI_Validator;
   }
   //FederateAmbassadorAttributeOwnership implementation

   public void
   requestAttributeOwnershipAssumption(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError
   {
      if (null != requestAttributeOwnershipAssumptionValidator)
requestAttributeOwnershipAssumptionValidator.validate(theObject,
offeredAttributes, userSuppliedTag);
   }

   public void
   requestDivestitureConfirmation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          AttributeDivestitureWasNotRequested,
          FederateInternalError
   {
      if (null != requestDivestitureConfirmationValidator)
requestDivestitureConfirmationValidator.validate(theObject,
offeredAttributes);
   }

   public void
   attributeOwnershipAcquisitionNotification(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   securedAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAcquisitionWasNotRequested,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError
   {
      if (null != attributeOwnershipAcquisitionNotificationValidator)
attributeOwnershipAcquisitionNotificationValidator.validate(theObject,
securedAttributes, userSuppliedTag);
   }
   public void
   attributeOwnershipUnavailable(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotRequested,
          FederateInternalError
   {
      if (null != attributeOwnershipUnavailableValidator)
attributeOwnershipUnavailableValidator.validate(theObject,
theAttributes);
   }

   public void
   requestAttributeOwnershipRelease(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   candidateAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      if (null != requestAttributeOwnershipReleaseValidator)
requestAttributeOwnershipReleaseValidator.validate(theObject,
candidateAttributes, userSuppliedTag);
   }

   public void
   confirmAttributeOwnershipAcquisitionCancellation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotCanceled,
          FederateInternalError
   {
      if (null !=
confirmAttributeOwnershipAcquisitionCancellationValidator)
confirmAttributeOwnershipAcquisitionCancellationValidator.validate(the
Object, theAttributes);
   }
   public void
   informAttributeOwnership(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute,
      FederateHandle       theOwner)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError
   {
      if (null != informAttributeOwnershipValidator)
informAttributeOwnershipValidator.validate(theObject, theAttribute,
theOwner);
      doInformOwnership(theObject, theAttribute, false, false,
theOwner);
   }

   public void
   attributeIsNotOwned(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError
   {
      if (null != attributeIsNotOwnedValidator)
attributeIsNotOwnedValidator.validate(theObject, theAttribute);
      doInformOwnership(theObject, theAttribute, true, false, null);
   }

   public void
   attributeIsOwnedByRTI(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError
   {
      if (null != attributeIsOwnedByRTIValidator)
attributeIsOwnedByRTIValidator.validate(theObject, theAttribute);
      doInformOwnership(theObject, theAttribute, false, true, null);
   }
   /**
    * This implementation funnels the informAttributeOwnership,
attributeIsNotOwned and
    * attributeIsOwnedByRTI callbacks to the doInformOwnership method,
    * so you can either override the relevant callback(s) or
doInformOwnership.
    * Missing arguments will be null.
    * Validation is handled by the callbacks.
    * @param theObject the {@link ObjectInstanceHandle} of the Object
whose instance attribute ownership is reported
    * @param theAttribute the {@link AttributeHandle} of the Attribute
whose ownership is reported
    * @param isUnowned a boolean which is true if the attribute is
unowned (isOwnedByRTI will be false and theOwner will be null), false
otherwise
    * @param isOwnedByRTI a boolean which is true if the attribute is
owned by the RTI (isUnowned will be false and theOwner will be null),
false otherwise
    * @param theOwner the {@link FederateHandle} of the owning
federate (when isUnowned and isOwnedByRTI are false), null otherwise
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#informAttributeOwnership
informAttributeOwnership
    * @see FederateAmbassador#attributeIsNotOwned attributeIsNotOwned
    * @see FederateAmbassador#attributeIsOwnedByRTI
attributeIsOwnedByRTI
    */
   public void
   doInformOwnership(
      final ObjectInstanceHandle theObject,
      final AttributeHandle      theAttribute,
      final boolean              isUnowned,
      final boolean              isOwnedByRTI,
      final FederateHandle       theOwner)
   throws FederateInternalError
   {
   }
}
//end FedAmbOwnershipListener
```

The `FedAmbRemovalResponder` class implements the `FederateAmbassadorObjectRemoval` interface. It funnels all three forms of the callback to a single method, `doRemove` (by supplying nulls for any missing arguments), allowing the programmer to either override the latter or the individual `FederateAmbassador` `removeObjectInstance` methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has a public member holding the validation interface reference. The callback methods invoke this if specified, before handing off to `doRemove`.

```
// File: FedAmbRemovalResponder.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * Null implementation of FederateAmbassadorObjectRemoval interface.
 * This implementation funnels all callbacks to the doRemove method,
 * so you can either override the relevant removeObjectInstance
method(s) or doRemove.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbRemovalResponder
   implements FederateAmbassadorObjectRemoval
{
   /**
    * The ValidateRemoveObjectInstance validation interface.
    */
   public ValidateRemoveObjectInstance
   removeObjectInstanceValidator;

   /**
    * Default constructor. Creates an instance with no validator in
place.
    */
   public
   FedAmbRemovalResponder()
   {
   }
   /**
    * Alternate constructor. Creates an instance with the specified
validator in place.
    * @param removeObjectInstance_Validator A
ValidateRemoveObjectInstance interface
    */
   public
   FedAmbRemovalResponder(
      ValidateRemoveObjectInstance removeObjectInstance_Validator)
   {
//    this();
      removeObjectInstanceValidator = removeObjectInstance_Validator;
   }

   //FederateAmbassadorObjectRemoval implementation

   public void
   removeObjectInstance(
      ObjectInstanceHandle theObject,
      byte[]               userSuppliedTag,
      OrderType            sentOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError
   {
      if (null != removeObjectInstanceValidator)
removeObjectInstanceValidator.validate(
         theObject, userSuppliedTag, sentOrdering);
      doRemove(theObject, userSuppliedTag, sentOrdering, null, null,
null);
   }

   public void
   removeObjectInstance(
   ObjectInstanceHandle theObject,
      byte[]            userSuppliedTag,
      OrderType         sentOrdering,
      LogicalTime       theTime,
      OrderType         receivedOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError
   {
      if (null != removeObjectInstanceValidator)
removeObjectInstanceValidator.validate(
         theObject, userSuppliedTag, sentOrdering, theTime,
receivedOrdering);
      doRemove(theObject, userSuppliedTag, sentOrdering, theTime,
receivedOrdering, null);
   }
   public void
   removeObjectInstance(
      ObjectInstanceHandle    theObject,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          InvalidLogicalTime,
          FederateInternalError
   {
      if (null != removeObjectInstanceValidator)
removeObjectInstanceValidator.validate(
         theObject, userSuppliedTag, sentOrdering, theTime,
receivedOrdering, retractionHandle);
      doRemove(theObject, userSuppliedTag, sentOrdering, theTime,
receivedOrdering, retractionHandle);
   }

   /**
    * This implementation funnels all removeObjectInstance callbacks
to this method,
    * so you can either override the relevant callback(s) or this
method.
    * Missing arguments will be null.
    * Validation is handled by the callbacks.
    * @param theObject the {@link ObjectInstanceHandle} of the
concerned object instance
    * @param userSuppliedTag a <code>byte[]</code> tag (this parameter
may be <code>null</code>)
    * @param sentOrdering the {@link OrderType} the message was sent
as
    * @param theTime the {@link LogicalTime} at which the deletion
occurs
    * @param receivedOrdering the {@link OrderType} the message was
received as
    * @param retractionHandle the {@link MessageRetractionHandle} of
the message
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#removeObjectInstance
removeObjectInstance
    */
   protected void
   doRemove(
      ObjectInstanceHandle    theObject,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws FederateInternalError
   {
   }
}
//end FedAmbRemovalResponder
```

The FedAmbRestoreListener class implements the FederateAmbassadorRestore interface. Of the seven callbacks, two pairs (requestFederationRestoreSucceeded/Failed and federation[Not]Restored) are funnelled to a single method each, doRequest and doRestore (by appending a Boolean argument in each case), allowing the programmer to either override the latter or the individual FederateAmbassador methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to doRequest or doRestore (if applicable).

```
// File: FedAmbRestoreListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A null implementation of the FederateAmbassadorRestore interface.
* This implementation funnels requestFederationRestoreSucceeded/Failed
to the doRequest method,
 * so you can either override those callbacks or doRequest.
 * Likewise, the federation[Not]Restored callbacks are funneled to the
doRestore method,
 * so you can either override those callbacks or doRestore.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbRestoreListener
   implements FederateAmbassadorRestore
{
   /**
    * The ValidateRequestFederationRestoreSucceeded validation
interface.
    */
   public ValidateRequestFederationRestoreSucceeded
   requestFederationRestoreSucceededValidator;

   /**
    * The ValidateRequestFederationRestoreFailed validation interface.
    */
   public ValidateRequestFederationRestoreFailed
   requestFederationRestoreFailedValidator;

   /**
    * The ValidateFederationRestoreBegun validation interface.
    */
   public ValidateFederationRestoreBegun
   federationRestoreBegunValidator;
```

```
    /**
     * The ValidateInitiateFederateRestore validation interface.
     */
    public ValidateInitiateFederateRestore
    initiateFederateRestoreValidator;

    /**
     * The ValidateFederationRestored validation interface.
     */
    public ValidateFederationRestored
    federationRestoredValidator;

    /**
     * The ValidateFederationNotRestored validation interface.
     */
    public ValidateFederationNotRestored
    federationNotRestoredValidator;

    /**
     * The ValidateFederationRestoreStatusResponse validation
interface.
     */
    public ValidateFederationRestoreStatusResponse
    federationRestoreStatusResponseValidator;

    /**
     * Default constructor. Creates an instance with no validators in
place.
     */
    public
    FedAmbRestoreListener()
    {
    }
```

```
   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param requestFederationRestoreSucceeded_Validator A
ValidateRequestFederationRestoreSucceeded interface
    * @param requestFederationRestoreFailed_Validator A
ValidateRequestFederationRestoreFailed interface
    * @param federationRestoreBegun_Validator A
ValidateFederationRestoreBegun interface
    * @param initiateFederateRestore_Validator A
ValidateInitiateFederateRestore interface
    * @param federationRestored_Validator A ValidateFederationRestored
interface
    * @param federationNotRestored_Validator A
ValidateFederationNotRestored interface
    * @param federationRestoreStatusResponse_Validator A
ValidateFederationRestoreStatusResponse interface
    */
   public
   FedAmbRestoreListener(
      ValidateRequestFederationRestoreSucceeded
requestFederationRestoreSucceeded_Validator,
      ValidateRequestFederationRestoreFailed
requestFederationRestoreFailed_Validator,
      ValidateFederationRestoreBegun
federationRestoreBegun_Validator,
      ValidateInitiateFederateRestore
initiateFederateRestore_Validator,
      ValidateFederationRestored
federationRestored_Validator,
      ValidateFederationNotRestored
federationNotRestored_Validator,
      ValidateFederationRestoreStatusResponse
federationRestoreStatusResponse_Validator)
   {
//    this();
      requestFederationRestoreSucceededValidator =
requestFederationRestoreSucceeded_Validator;
      requestFederationRestoreFailedValidator    =
requestFederationRestoreFailed_Validator;
      federationRestoreBegunValidator            =
federationRestoreBegun_Validator;
      initiateFederateRestoreValidator           =
initiateFederateRestore_Validator;
      federationRestoredValidator                =
federationRestored_Validator;
      federationNotRestoredValidator             =
federationNotRestored_Validator;
      federationRestoreStatusResponseValidator   =
federationRestoreStatusResponse_Validator;
   }
   //FederateAmbassadorRestore implementation

   public void
   requestFederationRestoreSucceeded(
      String label)
   throws FederateInternalError
   {
      if (null != requestFederationRestoreSucceededValidator)
requestFederationRestoreSucceededValidator.validate(label);
      doRequest(label, true);
   }

   public void
   requestFederationRestoreFailed(
      String label)
   throws FederateInternalError
   {
      if (null != requestFederationRestoreFailedValidator)
requestFederationRestoreFailedValidator.validate(label);
      doRequest(label, false);
   }

   public void
   federationRestoreBegun()
   throws FederateInternalError
   {
      if (null != federationRestoreBegunValidator)
federationRestoreBegunValidator.validate();
   }

   public void
   initiateFederateRestore(
      String         label,
      FederateHandle federateHandle)
   throws SpecifiedSaveLabelDoesNotExist,
          CouldNotInitiateRestore,
          FederateInternalError
   {
      if (null != initiateFederateRestoreValidator)
initiateFederateRestoreValidator.validate(label, federateHandle);
      throw new CouldNotInitiateRestore("FedAmbRestoreListener cannot
initiate a federation restore");
   }

   public void
   federationRestored()
   throws FederateInternalError
   {
      if (null != federationRestoredValidator)
federationRestoredValidator.validate();
      doRestore(null);
   }
   public void
   federationNotRestored(
      RestoreFailureReason reason)
   throws FederateInternalError
   {
      if (null != federationNotRestoredValidator)
federationNotRestoredValidator.validate(reason);
      doRestore(reason);
   }

   public void
   federationRestoreStatusResponse(
      FederateHandleRestoreStatusPair[] response)
   throws FederateInternalError
   {
      if (null != federationRestoreStatusResponseValidator)
federationRestoreStatusResponseValidator.validate(response);
   }

   /**
    * This implementation funnels the
requestFederationRestoreSucceeded/Failed callbacks to this method,
    * so you can either override the relevant callback(s) or this
method.
    * Validation is handled by the callbacks.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @param succeeded a boolean indicating whether the request
succeeded or not
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#requestFederationRestore
requestFederationRestore
    * @see FederateAmbassador#requestFederationRestoreSucceeded
requestFederationRestoreSucceeded
    * @see FederateAmbassador#requestFederationRestoreFailed
requestFederationRestoreFailed
    */
   protected void
   doRequest(
      String label,
      boolean succeeded)
   throws FederateInternalError
   {
   }
   /**
    * This implementation funnels the federation[Not]Restored
callbacks to this method,
    * so you can either override the relevant callback(s) or this
method.
    * Validation is handled by the callbacks.
    * @param reason a {@link RestoreFailureReason} specifying the
reason for the failure;
    *               if null, it means the restore succeeded
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see FederateAmbassador#federationRestored federationRestored
    * @see FederateAmbassador#federationNotRestored
federationNotRestored
    */
   protected void
   doRestore(
      RestoreFailureReason reason)
   throws FederateInternalError
   {
   }
}
//end FedAmbRestoreListener
```

The `FedAmbSaveListener` class implements the `FederateAmbassadorSave` interface. Of the four callbacks, one pair (`federation[Not]Saved`) is funnelled to a single method, `doSave` (by appending a Boolean argument), and the two forms of another (`initiateFederateSave`) are funnelled to another single method, `doInitiateSave` (by supplying a null for an eventual missing argument). This allows the programmer to either override the latter or the individual `FederateAmbassador` methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to `doSave` or `doInitiateSave` (if applicable).

```
// File: FedAmbSaveListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A null implementation of the FederateAmbassadorSave interface.
 * This implementation funnels the federation[Not]Saved callbacks to
the doSave method,
 * so you can either override the relevant callback(s) or doSave.
 * Likewise, the initiateFederateSave callbacks are funnelled to the
doInitiateSave method,
 * so you can either override the relevant callback(s) or
doInitiateSave.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbSaveListener
   implements FederateAmbassadorSave
{
   /**
    * The ValidateInitiateFederateSave validation interface.
    */
   public ValidateInitiateFederateSave
   initiateFederateSaveValidator;

   /**
    * The ValidateFederationSaved validation interface.
    */
   public ValidateFederationSaved
   federationSavedValidator;

   /**
    * The ValidateFederationNotSaved validation interface.
    */
   public ValidateFederationNotSaved
   federationNotSavedValidator;
   /**
    * The ValidateFederationSaveStatusResponse validation interface.
    */
   public ValidateFederationSaveStatusResponse
   federationSaveStatusResponseValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbSaveListener()
   {
   }

   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param initiateFederateSave_Validator A
ValidateInitiateFederateSave interface
    * @param federationSaved_Validator A ValidateFederationSaved
interface
    * @param federationNotSaved_Validator A ValidateFederationNotSaved
interface
    * @param federationSaveStatusResponse_Validator A
ValidateFederationSaveStatusResponse interface
    */
   public
   FedAmbSaveListener(
      ValidateInitiateFederateSave
initiateFederateSave_Validator,
      ValidateFederationSaved              federationSaved_Validator,
      ValidateFederationNotSaved
federationNotSaved_Validator,
      ValidateFederationSaveStatusResponse
federationSaveStatusResponse_Validator)
   {
//    this();
      initiateFederateSaveValidator         =
initiateFederateSave_Validator;
      federationSavedValidator              =
federationSaved_Validator;
      federationNotSavedValidator           =
federationNotSaved_Validator;
      federationSaveStatusResponseValidator =
federationSaveStatusResponse_Validator;
   }
   //FederateAmbassadorSave implementation

   public void
   initiateFederateSave(
      String label)
   throws UnableToPerformSave,
          FederateInternalError
   {
      if (null != initiateFederateSaveValidator)
initiateFederateSaveValidator.validate(label);
      doInitiateSave(label, null);
   }

   public void
   initiateFederateSave(
      String      label,
      LogicalTime time)
   throws InvalidLogicalTime,
          UnableToPerformSave,
          FederateInternalError
   {
      if (null != initiateFederateSaveValidator)
initiateFederateSaveValidator.validate(label, time);
      doInitiateSave(label, time);
   }

   public void
   federationSaved()
   throws FederateInternalError
   {
      if (null != federationSavedValidator)
federationSavedValidator.validate();
      doSave(null);
   }

   public void
   federationNotSaved(
      SaveFailureReason reason)
   throws FederateInternalError
   {
      if (null != federationNotSavedValidator)
federationNotSavedValidator.validate(reason);
      doSave(reason);
   }

   public void
   federationSaveStatusResponse(
      FederateHandleSaveStatusPair[] response)
   throws FederateInternalError
   {
      if (null != federationSaveStatusResponseValidator)
federationSaveStatusResponseValidator.validate(response);
   }
   /**
    * This implementation funnels the initiateFederateSave callbacks
to this method,
    * so you can either override the relevant callback(s) or this
method.
    * Missing arguments will be null.
    * Validation is handled by the callbacks.
    * @param label a {@link java.lang.String} holding the saved
state's identifier
    * @param time a {@link LogicalTime} specifying when the save was
scheduled
    * @throws UnableToPerformSave should be thrown if the save
operation seems doomed
    * @throws FederateInternalError should be thrown if something else
goes wrong
    * @see FederateAmbassador#initiateFederateSave
initiateFederateSave
    */
   protected void
   doInitiateSave(
      String      label,
      LogicalTime time)
   throws UnableToPerformSave,
          FederateInternalError
   {
   }

   /**
    * This implementation funnels the federation[Not]Saved callbacks
to this method,
    * so you can either override the relevant callback(s) or this
method.
    * Validation is handled by the callbacks.
    * @param reason a {@link SaveFailureReason} specifying the reason
for the failure;
    *               if null, it means the save succeeded
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see FederateAmbassador#federationSaved federationSaved
    * @see FederateAmbassador#federationNotSaved federationNotSaved
    */
   protected void
   doSave(
      SaveFailureReason reason)
   throws FederateInternalError
   {
   }
}
//end FedAmbSaveListener
```

The `FedAmbSynchronizationListener` class implements the `FederateAmbassadorSynchronization` interface. Of the four callbacks, it funnels a pair (`synchronizationPointRegistrationSucceeded/Failed`) to a single method, `doRegistration` (by supplying a null for an eventual missing argument), allowing the programmer to either override the latter or the individual `FederateAmbassador` methods, depending on what is more convenient. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified, before handing off to `doRegistration` (if applicable).

```
// File: FedAmbSynchronizationListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
 * A null implementation of the FederateAmbassadorSynchronization
interface.
 * Note that a more satisfactory implementation would respond to the
announceSynchronizationPoint
 * callback with
_RTIambassador.synchronizationPointAchieved(synchronizationPointLabel)
;
 * but this cannot be done here as we're lacking an RTIambassador
reference.
 * This implementation also funnels
synchronizationPointRegistrationSucceeded/Failed to the doRegistration
method,
 * so you can either override those callbacks or doRegistration.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbSynchronizationListener
   implements FederateAmbassadorSynchronization
{
   /**
    * The ValidateSynchronizationPointRegistrationSucceeded validation
interface.
    */
   public ValidateSynchronizationPointRegistrationSucceeded
   synchronizationPointRegistrationSucceededValidator;

   /**
    * The ValidateSynchronizationPointRegistrationFailed validation
interface.
    */
   public ValidateSynchronizationPointRegistrationFailed
   synchronizationPointRegistrationFailedValidator;
   /**
    * The ValidateAnnounceSynchronizationPoint validation interface.
    */
   public ValidateAnnounceSynchronizationPoint
   announceSynchronizationPointValidator;

   /**
    * The ValidateFederationSynchronized validation interface.
    */
   public ValidateFederationSynchronized
   federationSynchronizedValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbSynchronizationListener()
   {
   }

   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param synchronizationPointRegistrationSucceeded_Validator A
ValidateSynchronizationPointRegistrationSucceeded interface
    * @param synchronizationPointRegistrationFailed_Validator A
ValidateSynchronizationPointRegistrationFailed interface
    * @param announceSynchronizationPoint_Validator A
ValidateAnnounceSynchronizationPoint interface
    * @param federationSynchronized_Validator A
ValidateFederationSynchronized interface
    */
   public
   FedAmbSynchronizationListener(
      ValidateSynchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded_Validator,
      ValidateSynchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed_Validator,
      ValidateAnnounceSynchronizationPoint
announceSynchronizationPoint_Validator,
      ValidateFederationSynchronized
federationSynchronized_Validator)
   {
//    this();
      synchronizationPointRegistrationSucceededValidator =
synchronizationPointRegistrationSucceeded_Validator;
      synchronizationPointRegistrationFailedValidator    =
synchronizationPointRegistrationFailed_Validator;
      announceSynchronizationPointValidator              =
announceSynchronizationPoint_Validator;
      federationSynchronizedValidator                    =
federationSynchronized_Validator;
   }
   //FederateAmbassadorSynchronization implementation

   public void
   synchronizationPointRegistrationSucceeded(
      String synchronizationPointLabel)
   throws FederateInternalError
   {
      if (null != synchronizationPointRegistrationSucceededValidator)
synchronizationPointRegistrationSucceededValidator.validate(synchroniz
ationPointLabel);
      doRegistration(synchronizationPointLabel, null);
   }

   public void
   synchronizationPointRegistrationFailed(
      String                              synchronizationPointLabel,
      SynchronizationPointFailureReason reason)
   throws FederateInternalError
   {
      if (null != synchronizationPointRegistrationFailedValidator)
synchronizationPointRegistrationFailedValidator.validate(synchronizati
onPointLabel, reason);
      doRegistration(synchronizationPointLabel, reason);
   }

   public void
   announceSynchronizationPoint(
      String synchronizationPointLabel,
      byte[] userSuppliedTag)
   throws FederateInternalError
   {
      if (null != announceSynchronizationPointValidator)
announceSynchronizationPointValidator.validate(synchronizationPointLab
el, userSuppliedTag);
      //A true null implementation would immediately fire back this
RTIambassador call:
//
_RTIambassador.synchronizationPointAchieved(synchronizationPointLabel)
;
   }

   public void
   federationSynchronized(
      String synchronizationPointLabel)
   throws FederateInternalError
   {
      if (null != federationSynchronizedValidator)
federationSynchronizedValidator.validate(synchronizationPointLabel);
   }
   /**
    * This implementation funnels the
synchronizationPointRegistrationSucceeded/Failed callbacks to this
method,
    * so you can either override the relevant callback(s) or this
method.
    * Validation is handled by the callbacks.
    * @param synchronizationPointLabel a {@link java.lang.String}
giving the synchronization point's identifier
    * @param reason a {@link SynchronizationPointFailureReason}
specifying what went wrong;
                    if null, it means the registration succeeded
    * @throws FederateInternalError should be thrown if something goes
wrong
    * @see RTIambassador#registerFederationSynchronizationPoint
registerFederationSynchronizationPoint
    * @see
FederateAmbassador#synchronizationPointRegistrationSucceeded
synchronizationPointRegistrationSucceeded
    * @see FederateAmbassador#synchronizationPointRegistrationFailed
synchronizationPointRegistrationFailed
    */
   protected void
   doRegistration(
      String                            synchronizationPointLabel,
      SynchronizationPointFailureReason reason)
   throws FederateInternalError
   {
   }
}
//end FedAmbSynchronizationListener
```

The `FedAmbTimeListener` class implements the `FederateAmbassadorTime` interface. Being a null implementation, it does nothing with the callbacks.

The class has public members holding the validation interface references. The callback methods invoke these if specified.

```
// File: FedAmbTimeListener.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import hla.rti1516.*;

/**
* A null implementation of the FederateAmbassadorTime interface.
 * <p>
 * The requestRetraction callback is tricky to dispatch. It refers to
 * a previously received reflectAttributeValues, receiveInteraction,
 * or removeObjectInstance callback. The second can be associated with
 * an InteractionClassHandle and the other two with an
 * ObjectInstanceHandle, but the Map between MessageRetractionHandles
 * and those is beyond the scope of a simple wrapper.
 * It may be pertinent to have some kind of "retraction co-ordinator"
 * associated with interaction classes and object instances, but such
 * handlers would need to be invoked separately by the Interaction
 * Listeners, Instance Attribute Listeners and the Time Listener.
 * Note that the Time Advance Grants would also have to be passed to
 * such a retraction co-ordinator, in order to dispose of retraction
 * handles that have become un-retractable.
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
public class
FedAmbTimeListener
   implements FederateAmbassadorTime
{
   /**
    * The ValidateRequestRetraction validation interface.
    */
   public ValidateRequestRetraction
   requestRetractionValidator;

   /**
    * The ValidateTimeAdvanceGrant validation interface.
    */
   public ValidateTimeAdvanceGrant
   timeAdvanceGrantValidator;

   /**
    * The ValidateTimeConstrainedEnabled validation interface.
    */
   public ValidateTimeConstrainedEnabled
   timeConstrainedEnabledValidator;
   /**
    * The ValidateTimeRegulationEnabled validation interface.
    */
   public ValidateTimeRegulationEnabled
   timeRegulationEnabledValidator;

   /**
    * Default constructor. Creates an instance with no validators in
place.
    */
   public
   FedAmbTimeListener()
   {
   }

   /**
    * Alternate constructor. Creates an instance with the specified
validators in place.
    * @param requestRetraction_Validator A ValidateRequestRetraction
interface
    * @param timeAdvanceGrant_Validator A ValidateTimeAdvanceGrant
interface
    * @param timeConstrainedEnabled_Validator A
ValidateTimeConstrainedEnabled interface
    * @param timeRegulationEnabled_Validator A
ValidateTimeRegulationEnabled interface
    */
   public
   FedAmbTimeListener(
      ValidateRequestRetraction      requestRetraction_Validator,
      ValidateTimeAdvanceGrant       timeAdvanceGrant_Validator,
      ValidateTimeConstrainedEnabled timeConstrainedEnabled_Validator,
      ValidateTimeRegulationEnabled  timeRegulationEnabled_Validator)
   {
//    this();
      requestRetractionValidator      = requestRetraction_Validator;
      timeAdvanceGrantValidator       = timeAdvanceGrant_Validator;
      timeConstrainedEnabledValidator =
timeConstrainedEnabled_Validator;
      timeRegulationEnabledValidator  =
timeRegulationEnabled_Validator;
   }

   //FederateAmbassadorTime implementation

   public void
   timeRegulationEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeRegulationWasPending,
          FederateInternalError
   {
      if (null != timeRegulationEnabledValidator)
timeRegulationEnabledValidator.validate(time);
   }
   public void
   timeConstrainedEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeConstrainedWasPending,
          FederateInternalError
   {
      if (null != timeConstrainedEnabledValidator)
timeConstrainedEnabledValidator.validate(time);
   }

   public void
   timeAdvanceGrant(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          JoinedFederateIsNotInTimeAdvancingState,
          FederateInternalError
   {
      if (null != timeAdvanceGrantValidator)
timeAdvanceGrantValidator.validate(theTime);
   }

   public void
   requestRetraction(
      MessageRetractionHandle theHandle)
   throws FederateInternalError
   {
      if (null != requestRetractionValidator)
requestRetractionValidator.validate(theHandle);
   }
}
//end FedAmbTimeListener
```

The `FedAmbWrapper` class implements the `FederateAmbassador` interface by serving as a dispatching layer between the callbacks and the event handlers. For each of the `FederateAmbassador…` sub-interfaces, `FedAmbWrapper` maintains a hash map of implementing objects, keyed by what is usually an object instance handle. When no handlers are registered for a given callback set, `FedAmbWrapper` acts as a null implementation.

Handlers can be registered in hierarchical fashion, at the object instance, object class, and default levels. For example, when a `reflectAttributeValues` callback is received, `FedAmbWrapper` will first look for a handler registered at the specific object instance handle received; failing that, it will look for a handler registered to the object instance's class; failing that again, it will look for a default handler (registered under the null key). Sub-interfaces keyed to object class handles (e.g. `ObjectDiscovery`) start the look-up process at the class level. The `Synchronization` and `NameReservation` sub-interfaces use strings (synchronization labels and object instance names, respectively) as keys. The `Restore`, `Save`, and `Time` sub-interfaces, finally, admit a single handler.

Because it incurs an overhead that may be significant, `FedAmbWrapper` should be used only when flexibility is more important than performance.

```
// File: FedAmbWrapper.java
package ca.gc.drdc_rddc.hla.rti1516.FedAmb;

import java.util.HashMap;
import hla.rti1516.*;

/**
 * This FederateAmbassador Wrapper class serves as a dispatcher;
 * before doing an RTIambassador call that expects FederateAmbassador
 * callbacks, you register a listener or responder with the
 * appropriate class of service and the designated key. When the
 * expected callback occurs, the FedAmbWrapper dispatches it to the
 * specified listener/responder. It is the listener/responder's
 * responsibility to validate the arguments it receives (throwing any
 * of the prescribed exceptions as required) and then thread-off any
 * remaining work.
 * <p>
 * Services that are invoked at the Instance level can have
 * listeners/responders registered at that level or at the Class
 * level. As a general rule, FedAmbWrapper will look for a registered
 * listener in the following sequence:
 * <ul>
 * <li> at the Instance level (ObjectInstanceHandle key);
 * <li> at the known Object Class level (ObjectClassHandle key);
 * <li> at the default level listener (null key); or
 * <li> do nothing.
 * </ul>
 * Notable exceptions are the discoveryListener, interactionListener,
 * interactionAdvisoryResponder and registrationResponder services
 * (which stop at the Class level); the nameReservationListener
 * service (which can only be refined at the name level); the
 * federationSynchronizationListener service (which can only be
 * refined at the synchronization label level); and the
 * federationSaveListener, federationRestoreListener and timeListener
 * services (which are undifferentiated).
 * <p>
 * Note that, because of the overloading, you'll need to typecast the
 * null to either ObjectClassHandle or ObjectInstanceHandle for the
 * set* method to be disambiguated. For example:
 * <p>
 * _fedAmbWrapper.setAttributeScopeListener((ObjectClassHandle)null,
new MyFederateAmbassadorAttributeScopeAdvisoryClient
attributeScopeListener());
 * <p>
 * Under IEEE 1516, the RTI is normally multi-threaded and thus each
 * FederateAmbassador callback occurs from a "Federate Service Thread"
 * belonging to the RTI (one per federate).
 * @author {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca RDDC
Valcartier})
 * @version 1.1
 */
```

```
public class
FedAmbWrapper
   implements FederateAmbassador
{
   /** We need an RTIambassador reference for some services. */
   private RTIambassador
   _rti;

   /** FederateAmbassadorAttributeScopeAdvisoryClient HashMap. */
   protected HashMap
   attributeScopeListeners;

   /** FederateAmbassadorAttributeScopeAdvisoryServer HashMap. */
   protected HashMap
   attributeScopeResponders;

   /** FederateAmbassadorAttributeUpdateClient HashMap. */
   protected HashMap
   attributeUpdateListeners;

   /** FederateAmbassadorAttributeUpdateServer HashMap. */
   protected HashMap
   attributeUpdateResponders;

   /** FederateAmbassadorObjectDiscovery HashMap. */
   protected HashMap
   discoveryListeners;

   /** FederateAmbassadorObjectRemoval HashMap. */
   protected HashMap
   removalResponders;

   /** FederateAmbassadorRestore HashMap. */
   protected HashMap
   federationRestoreListeners;

   /** FederateAmbassadorSave HashMap. */
   protected HashMap
   federationSaveListeners;

   /** FederateAmbassadorSynchronization HashMap. */
   protected HashMap
   federationSynchronizationListeners;

   /** FederateAmbassadorInteractionAdvisory HashMap. */
   protected HashMap
   interactionAdvisoryResponders;

   /** FederateAmbassadorInteractionOccurrence HashMap. */
   protected HashMap
   interactionListeners;

   /** FederateAmbassadorNameReservation HashMap. */
   protected HashMap
   nameReservationListeners;
```

```
/** FederateAmbassadorAttributeOwnership HashMap. */
protected HashMap
ownershipListeners;

/** FederateAmbassadorObjectRegistrationAdvisory HashMap. */
protected HashMap
registrationResponders;

/** FederateAmbassadorTime HashMap. */
protected HashMap
timeListeners;

/**
 * Constructor.
 * @param rti an RTIambassador to be used by some services
 */
public
FedAmbWrapper(RTIambassador rti)
{
   _rti = rti;
   attributeScopeListeners            = new HashMap();
   attributeScopeResponders           = new HashMap();
   attributeUpdateResponders          = new HashMap();
   attributeUpdateListeners           = new HashMap();
   discoveryListeners                 = new HashMap();
   removalResponders                  = new HashMap();
   federationRestoreListeners         = new HashMap();
   federationSaveListeners            = new HashMap();
   federationSynchronizationListeners = new HashMap();
   interactionAdvisoryResponders      = new HashMap();
   interactionListeners               = new HashMap();
   nameReservationListeners           = new HashMap();
   ownershipListeners                 = new HashMap();
   registrationResponders             = new HashMap();
   timeListeners                      = new HashMap();
}
```

```
   /**
    * Associates an attributeScopeListener with a specified 
ObjectInstanceHandle.
    * The null ObjectInstanceHandle designates the default (fall-
through) listener.
    * A null FederateAmbassadorAttributeScopeAdvisoryClient 
unassociates the ObjectInstanceHandle.
    * @param theObject the ObjectInstanceHandle with which to 
associate the listener;
    * the null value is the default (fall-through) listener
    * @param attributeScopeListener the 
FederateAmbassadorAttributeScopeAdvisoryClient to associate with
    * the specified ObjectInstanceHandle; if null, behaves as a 
remove()
    * @return the previous attributeScopeListener associated with the 
ObjectInstanceHandle
    * (null if there was no previous mapping)
    */
   public Object
   setAttributeScopeListener(
      ObjectInstanceHandle                           theObject,
      FederateAmbassadorAttributeScopeAdvisoryClient 
attributeScopeListener)
   {
      if (null==attributeScopeListener)
      {
         return attributeScopeListeners.remove(theObject);
      }
      else
      {
         return attributeScopeListeners.put(theObject, 
attributeScopeListener);
      }
   }
   /**
    * Associates an attributeScopeListener with a specified
ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
listener.
    * A null FederateAmbassadorAttributeScopeAdvisoryClient
unassociates the ObjectClassHandle.
    * @param theObjectClass the ObjectClassHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param attributeScopeListener the
FederateAmbassadorAttributeScopeAdvisoryClient to associate with
    * the specified ObjectClassHandle; if null, behaves as a remove()
    * @return the previous attributeScopeListener associated with the
ObjectClassHandle
    * (null if there was no previous mapping)
    */
   public Object
   setAttributeScopeListener(
      ObjectClassHandle                              theObjectClass,
      FederateAmbassadorAttributeScopeAdvisoryClient
attributeScopeListener)
   {
      if (null==attributeScopeListener)
      {
         return attributeScopeListeners.remove(theObjectClass);
      }
      else
      {
         return attributeScopeListeners.put(theObjectClass,
attributeScopeListener);
      }
   }
   /**
    * Associates an attributeScopeResponder with a specified
ObjectInstanceHandle.
    * The null ObjectInstanceHandle designates the default (fall-
through) responder.
    * A null FederateAmbassadorAttributeScopeAdvisoryServer
unassociates the ObjectInstanceHandle.
    * @param theObject the ObjectInstanceHandle with which to
associate the responder;
    * the null value is the default (fall-through) responder
    * @param attributeScopeResponder the
FederateAmbassadorAttributeScopeAdvisoryServer to associate with
    * the specified ObjectInstanceHandle; if null, behaves as a
remove()
    * @return the previous attributeScopeResponder associated with the
ObjectInstanceHandle
    * (null if there was no previous mapping)
    */
   public Object
   setAttributeScopeResponder(
      ObjectInstanceHandle                           theObject,
      FederateAmbassadorAttributeScopeAdvisoryServer
attributeScopeResponder)
   {
      if (null==attributeScopeResponder)
      {
         return attributeScopeResponders.remove(theObject);
      }
      else
      {
         return attributeScopeResponders.put(theObject,
attributeScopeResponder);
      }
   }
   /**
    * Associates an attributeScopeResponder with a specified
ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
responder.
    * A null FederateAmbassadorAttributeScopeAdvisoryServer
unassociates the ObjectClassHandle.
    * @param theObjectClass the ObjectClassHandle with which to
associate the responder;
    *                       the null value is the default (fall-
through) responder
    * @param attributeScopeResponder the
FederateAmbassadorAttributeScopeAdvisoryServer to associate with
    *                                the specified ObjectClassHandle;
if null, behaves as a remove()
    * @return the previous attributeScopeResponder associated with the
ObjectClassHandle
    *         (null if there was no previous mapping)
    */
   public Object
   setAttributeScopeResponder(
      ObjectClassHandle                              theObjectClass,
      FederateAmbassadorAttributeScopeAdvisoryServer
attributeScopeResponder)
   {
      if (null==attributeScopeResponder)
      {
         return attributeScopeResponders.remove(theObjectClass);
      }
      else
      {
         return attributeScopeResponders.put(theObjectClass,
attributeScopeResponder);
      }
   }
   /**
    * Associates an attributeUpdateListener with a specified
ObjectInstanceHandle.
    * The null ObjectInstanceHandle designates the default (fall-
through) listener.
    * A null FederateAmbassadorAttributeUpdateClient unassociates the
ObjectInstanceHandle.
    * @param theObject the ObjectInstanceHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param attributeUpdateListener the
FederateAmbassadorAttributeUpdateClient to associate with
    * the specified ObjectInstanceHandle; if null, behaves as a
remove()
    * @return the previous attributeUpdateListener associated with the
ObjectInstanceHandle
    * (null if there was no previous mapping)
    */
   public Object
   setAttributeUpdateListener(
      ObjectInstanceHandle                    theObject,
      FederateAmbassadorAttributeUpdateClient attributeUpdateListener)
   {
      if (null==attributeUpdateListener)
      {
         return attributeUpdateListeners.remove(theObject);
      }
      else
      {
         return attributeUpdateListeners.put(theObject,
attributeUpdateListener);
      }
   }
   /**
    * Associates an attributeUpdateListener with a specified
ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
listener.
    * A null FederateAmbassadorAttributeUpdateClient unassociates the
ObjectClassHandle.
    * @param theObjectClass the ObjectClassHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param attributeUpdateListener the
FederateAmbassadorAttributeUpdateClient to associate with
    * the specified ObjectClassHandle; if null, behaves as a remove()
    * @return the previous attributeUpdateListener associated with the
ObjectClassHandle
    * (null if there was no previous mapping)
    */
   public Object
   setAttributeUpdateListener(
      ObjectClassHandle                       theObjectClass,
      FederateAmbassadorAttributeUpdateClient attributeUpdateListener)
   {
      if (null==attributeUpdateListener)
      {
         return attributeUpdateListeners.remove(theObjectClass);
      }
      else
      {
         return attributeUpdateListeners.put(theObjectClass,
attributeUpdateListener);
      }
   }
   /**
    * Associates an attributeUpdateResponder with a specified
ObjectInstanceHandle.
    * The null ObjectInstanceHandle designates the default (fall-
through) responder.
    * A null FederateAmbassadorAttributeUpdateServer unassociates the
ObjectInstanceHandle.
    * @param theObject the ObjectInstanceHandle with which to
associate the responder;
    * the null value is the default (fall-through) responder
    * @param attributeUpdateResponder the
FederateAmbassadorAttributeUpdateServer to associate with
    * the specified ObjectInstanceHandle; if null, behaves as a
remove()
    * @return the previous attributeUpdateResponder associated with
the ObjectInstanceHandle
    * (null if there was no previous mapping)
    */
   public Object
   setAttributeUpdateResponder(
      ObjectInstanceHandle                    theObject,
      FederateAmbassadorAttributeUpdateServer
attributeUpdateResponder)
   {
      if (null==attributeUpdateResponder)
      {
         return attributeUpdateResponders.remove(theObject);
      }
      else
      {
         return attributeUpdateResponders.put(theObject,
attributeUpdateResponder);
      }
   }
   /**
    * Associates an attributeUpdateResponder with a specified
ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
responder.
    * A null FederateAmbassadorAttributeUpdateServer unassociates the
ObjectClassHandle.
    * @param theObjectClass the ObjectClassHandle with which to
associate the responder;
    * the null value is the default (fall-through) responder
    * @param attributeUpdateResponder the
FederateAmbassadorAttributeUpdateServer to associate with
    * the specified ObjectClassHandle; if null, behaves as a remove()
    * @return the previous attributeUpdateResponder associated with
the ObjectClassHandle
    * (null if there was no previous mapping)
    */
   public Object
   setAttributeUpdateResponder(
      ObjectClassHandle                       theObjectClass,
      FederateAmbassadorAttributeUpdateServer
attributeUpdateResponder)
   {
      if (null==attributeUpdateResponder)
      {
         return attributeUpdateResponders.remove(theObjectClass);
      }
      else
      {
         return attributeUpdateResponders.put(theObjectClass,
attributeUpdateResponder);
      }
   }
   /**
    * Associates a discoveryListener with a specified
ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
listener.
    * A null FederateAmbassadorObjectDiscovery unassociates the
ObjectClassHandle.
    * @param theObjectClass the ObjectClassHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param discoveryListener the FederateAmbassadorObjectDiscovery
to associate with
    * the specified ObjectClassHandle; if null, behaves as a remove()
    * @return the previous discoveryListener associated with the
ObjectClassHandle
    * (null if there was no previous mapping)
    */
   public Object
   setDiscoveryListener(
      ObjectClassHandle                 theObjectClass,
      FederateAmbassadorObjectDiscovery discoveryListener)
   {
      if (null==discoveryListener)
      {
         return discoveryListeners.remove(theObjectClass);
      }
      else
      {
         return discoveryListeners.put(theObjectClass,
discoveryListener);
      }
   }
   /**
    * Associates a removalResponder with a specified
ObjectInstanceHandle.
    * The null ObjectInstanceHandle designates the default (fall-
through) listener.
    * A null FederateAmbassadorObjectRemoval unassociates the
ObjectInstanceHandle.
    * @param theObject the ObjectInstanceHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param removalResponder the FederateAmbassadorObjectRemoval to
associate with
    * the specified ObjectInstanceHandle; if null, behaves as a
remove()
    * @return the previous removalResponder associated with the
ObjectInstanceHandle
    * (null if there was no previous mapping)
    */
   public Object
   setRemovalResponder(
      ObjectInstanceHandle            theObject,
      FederateAmbassadorObjectRemoval removalResponder)
   {
      if (null==removalResponder)
      {
         return removalResponders.remove(theObject);
      }
      else
      {
         return removalResponders.put(theObject, removalResponder);
      }
   }
   /**
    * Associates a removalResponder with a specified
ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
listener.
    * A null FederateAmbassadorObjectRemoval unassociates the
ObjectClassHandle.
    * @param theObjectClass the ObjectClassHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param removalResponder the FederateAmbassadorObjectRemoval to
associate with
    * the specified ObjectClassHandle; if null, behaves as a remove()
    * @return the previous removalResponder associated with the
ObjectClassHandle
    * (null if there was no previous mapping)
    */
   public Object
   setRemovalResponder(
      ObjectClassHandle               theObjectClass,
      FederateAmbassadorObjectRemoval removalResponder)
   {
      if (null==removalResponder)
      {
         return removalResponders.remove(theObjectClass);
      }
      else
      {
         return removalResponders.put(theObjectClass,
removalResponder);
      }
   }
   /**
    * Sets the federationRestoreListener.
    * Unlike the other callback subsets, no dispatching occurs (ther
can be only one listener).
    * A null FederateAmbassadorRestore is allowed.
    * @param federationRestoreListener the FederateAmbassadorRestore
to associate;
    * if null, behaves as a remove()
    * @return the previous federationRestoreListener (null if there
was no previous mapping)
    */
   public Object
   setFederationRestoreListener(
      FederateAmbassadorRestore federationRestoreListener)
   {
      if (null==federationRestoreListener)
      {
         return federationRestoreListeners.remove(null);
      }
      else
      {
         return federationRestoreListeners.put(null,
federationRestoreListener);
      }
   }

   /**
    * Sets the federationSaveListener.
    * Unlike the other callback subsets, no dispatching occurs (ther
can be only one listener).
    * A null FederateAmbassadorSave is allowed.
    * @param federationSaveListener the FederateAmbassadorSave to
associate;
    * if null, behaves as a remove()
    * @return the previous federationSaveListener (null if there was
no previous mapping)
    */
   public Object
   setFederationSaveListener(
      FederateAmbassadorSave federationSaveListener)
   {
      if (null==federationSaveListener)
      {
         return federationSaveListeners.remove(null);
      }
      else
      {
         return federationSaveListeners.put(null,
federationSaveListener);
      }
   }
   /**
    * Associates a federationSynchronizationListener with a specified
synchronization label.
    * The null String (not the empty String) designates the default
(fall-through) listener.
    * A null FederateAmbassadorSynchronization unassociates the
String.
    * @param synchronizationPointLabel the String with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param federationSynchronizationListener the
FederateAmbassadorSynchronization to associate with
    * the specified String; if null, behaves as a remove()
    * @return the previous federationSynchronizationListener
associated with the String
    * (null if there was no previous mapping)
    */
   public Object
   setFederationSynchronizationListener(
      String                            synchronizationPointLabel,
      FederateAmbassadorSynchronization
federationSynchronizationListener)
   {
      if (null==federationSynchronizationListener)
      {
         return
federationSynchronizationListeners.remove(synchronizationPointLabel);
      }
      else
      {
         return
federationSynchronizationListeners.put(synchronizationPointLabel,
federationSynchronizationListener);
      }
   }
   //FederateAmbassadorInteractionAdvisory

   /**
    * Associates an interactionAdvisoryResponder with a specified
InteractionClassHandle.
    * The null InteractionClassHandle designates the default (fall-
through) listener.
    * A null FederateAmbassadorInteractionAdvisory unassociates the
InteractionClassHandle.
    * @param interactionClass the InteractionClassHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param interactionAdvisoryResponder the
FederateAmbassadorInteractionAdvisory to associate with
    * the specified interactionClass; if null, behaves as a remove()
    * @return the previous interactionAdvisoryResponder associated
with the interactionClass
    * (null if there was no previous mapping)
    */
   public Object
   setInteractionAdvisoryResponder(
      InteractionClassHandle                interactionClass,
      FederateAmbassadorInteractionAdvisory
interactionAdvisoryResponder)
   {
      if (null==interactionAdvisoryResponder)
      {
         return
interactionAdvisoryResponders.remove(interactionClass);
      }
      else
      {
         return interactionAdvisoryResponders.put(interactionClass,
interactionAdvisoryResponder);
      }
   }
   /**
    * Associates an interactionListener with a specified
InteractionClassHandle.
    * The null InteractionClassHandle designates the default (fall-
through) listener.
    * A null FederateAmbassadorInteractionOccurrence unassociates the
InteractionClassHandle.
    * @param interactionClass the InteractionClassHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param interactionListener the
FederateAmbassadorInteractionOccurrence to associate with
    * the specified interactionClass; if null, behaves as a remove()
    * @return the previous interactionListener associated with the
interactionClass
    * (null if there was no previous mapping)
    */
   public Object
   setInteractionListener(
      InteractionClassHandle                  interactionClass,
      FederateAmbassadorInteractionOccurrence interactionListener)
   {
      if (null==interactionListener)
      {
         return interactionListeners.remove(interactionClass);
      }
      else
      {
         return interactionListeners.put(interactionClass,
interactionListener);
      }
   }
   /**
    * Associates a nameReservationListener with a specified String.
    * The null String (not the empty String) designates the default
(fall-through) listener.
    * A null FederateAmbassadorNameReservation unassociates the
String.
    * @param objectName the String with which to associate the
listener;
    * the null value is the default (fall-through) listener
    * @param nameReservationListener the
FederateAmbassadorNameReservation to associate with
    * the specified objectName; if null, behaves as a remove()
    * @return the previous nameReservationListener associated with the
objectName
    * (null if there was no previous mapping)
    */
   public Object
   setNameReservationListener(
      String                            objectName,
      FederateAmbassadorNameReservation nameReservationListener)
   {
      if (null==nameReservationListener)
      {
         return nameReservationListeners.remove(objectName);
      }
      else
      {
         return nameReservationListeners.put(objectName,
nameReservationListener);
      }
   }
   /**
    * Associates an InstanceAttributeOwnershipListener with a
specified ObjectInstanceHandle.
    * The null ObjectInstanceHandle designates the default (fall-
through) listener.
    * A null FederateAmbassadorAttributeOwnership unassociates the
ObjectInstanceHandle.
    * @param theObject the ObjectInstanceHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param ownershipListener the
FederateAmbassadorAttributeOwnership to associate with
    * the specified ObjectInstanceHandle; if null, behaves as a
remove()
    * @return the previous ownershipListener associated with the
theObject
    * (null if there was no previous mapping)
    */
   public Object
   setOwnershipListener(
      ObjectInstanceHandle                 theObject,
      FederateAmbassadorAttributeOwnership ownershipListener)
   {
      if (null==ownershipListener)
      {
         return ownershipListeners.remove(theObject);
      }
      else
      {
         return ownershipListeners.put(theObject, ownershipListener);
      }
   }
   /**
    * Associates an InstanceAttributeOwnershipListener with a
specified ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
listener.
    * A null FederateAmbassadorAttributeOwnership unassociates the
ObjectClassHandle.
    * @param theObjectClass the ObjectClassHandle with which to
associate the listener;
    * the null value is the default (fall-through) listener
    * @param ownershipListener the
FederateAmbassadorAttributeOwnership to associate with
    * the specified ObjectClassHandle; if null, behaves as a remove()
    * @return the previous ownershipListener associated with the
ObjectClassHandle
    * (null if there was no previous mapping)
    */
   public Object
   setOwnershipListener(
      ObjectClassHandle                    theObjectClass,
      FederateAmbassadorAttributeOwnership ownershipListener)
   {
      if (null==ownershipListener)
      {
         return ownershipListeners.remove(theObjectClass);
      }
      else
      {
         return ownershipListeners.put(theObjectClass,
ownershipListener);
      }
   }
   /**
    * Associates a RegistrationAdvisoryResponder with a specified
ObjectClassHandle.
    * The null ObjectClassHandle designates the default (fall-through)
responder.
    * A null FederateAmbassadorObjectRegistrationAdvisory unassociates
the ObjectClassHandle.
    * @param theClass the ObjectClassHandle with which to associate
the responder;
    * the null value is the default (fall-through) responder
    * @param registrationResponder the
FederateAmbassadorObjectRegistrationAdvisory to associate with
    * the specified ObjectClassHandle; if null, behaves as a remove()
    * @return the previous registrationResponder associated with the
theClass
    * (null if there was no previous mapping)
    */
   public Object
   setRegistrationResponder(
      ObjectClassHandle                            theClass,
      FederateAmbassadorObjectRegistrationAdvisory
registrationResponder)
   {
      if (null==registrationResponder)
      {
         return registrationResponders.remove(theClass);
      }
      else
      {
         return registrationResponders.put(theClass,
registrationResponder);
      }
   }

   /**
    * Sets the timeListener.
    * Unlike the other callback subsets, no dispatching occurs (ther
can be only one listener).
    * A null FederateAmbassadorTime is allowed.
    * @param timeListener the FederateAmbassadorTime to associate; if
null, behaves as a remove()
    * @return the previous federationTimeListener (null if there was
no previous mapping)
    */
   public Object
   setTimeListener(
      FederateAmbassadorTime timeListener)
   {
      if (null==timeListener)
      {
         return timeListeners.remove(null);
      }
      else
      {
         return timeListeners.put(null, timeListener);
      }
   }
   ///////////////////////////////////////
   // FederateAmbassador implementation //
   ///////////////////////////////////////

   //FederateAmbassadorAttributeOwnership part

   private FederateAmbassadorAttributeOwnership
   getOwnershipListener(
      ObjectInstanceHandle theObject)
   {
      Object listener = ownershipListeners.get(theObject);
      //Fall-through to Class level?
      try
      {
         if (null==listener) listener =
ownershipListeners.get(_rti.getKnownObjectClassHandle(theObject));
         //Fall-through to default handler?
         if (null==listener) listener = ownershipListeners.get(null);
         //Otherwise, give up
         if (null==listener) return null;
         return (FederateAmbassadorAttributeOwnership)listener;
      }
      //ObjectInstanceNotKnown, etc. can't happen
      catch (RTIexception ignored) { return null; }
   }

   public void
   requestAttributeOwnershipAssumption(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError
   {
      try
      {

getOwnershipListener(theObject).requestAttributeOwnershipAssumption(th
eObject, offeredAttributes, userSuppliedTag);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   requestDivestitureConfirmation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          AttributeDivestitureWasNotRequested,
          FederateInternalError
   {
      try
      {

getOwnershipListener(theObject).requestDivestitureConfirmation(theObje
ct, offeredAttributes);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   attributeOwnershipAcquisitionNotification(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   securedAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAcquisitionWasNotRequested,
          AttributeAlreadyOwned,
          AttributeNotPublished,
          FederateInternalError
   {
      try
      {

getOwnershipListener(theObject).attributeOwnershipAcquisitionNotificat
ion(theObject, securedAttributes, userSuppliedTag);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   attributeOwnershipUnavailable(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotRequested,
          FederateInternalError
   {
      try
      {

getOwnershipListener(theObject).attributeOwnershipUnavailable(theObjec
t, theAttributes);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   requestAttributeOwnershipRelease(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   candidateAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      try
      {

getOwnershipListener(theObject).requestAttributeOwnershipRelease(theOb
ject, candidateAttributes, userSuppliedTag);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   confirmAttributeOwnershipAcquisitionCancellation(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeAlreadyOwned,
          AttributeAcquisitionWasNotCanceled,
          FederateInternalError
   {
      try
      {

getOwnershipListener(theObject).confirmAttributeOwnershipAcquisitionCa
ncellation(theObject, theAttributes);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   informAttributeOwnership(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute,
      FederateHandle       theOwner)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError
   {
      try
      {
getOwnershipListener(theObject).informAttributeOwnership(theObject,
theAttribute, theOwner);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   attributeIsNotOwned(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError
   {
      try
      {
getOwnershipListener(theObject).attributeIsNotOwned(theObject,
theAttribute);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   attributeIsOwnedByRTI(
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          FederateInternalError
   {
      try
      {
getOwnershipListener(theObject).attributeIsOwnedByRTI(theObject,
theAttribute);
      }
      catch (NullPointerException ignored) {}
   }
   //FederateAmbassadorAttributeScopeAdvisoryClient part

   private FederateAmbassadorAttributeScopeAdvisoryClient
   getAttributeScopeListener(
      ObjectInstanceHandle theObject)
   {
      Object listener = attributeScopeListeners.get(theObject);
      //Fall-through to Class level?
      try
      {
         if (null==listener) listener =
attributeScopeListeners.get(_rti.getKnownObjectClassHandle(theObject))
;
         //Fall-through to default handler?
         if (null==listener) listener =
attributeScopeListeners.get(null);
         //Otherwise, give up
         if (null==listener) return null;
         return
(FederateAmbassadorAttributeScopeAdvisoryClient)listener;
      }
      //ObjectInstanceNotKnown, etc. can't happen
      catch (RTIexception ignored) { return null; }
   }

   public void
   attributesInScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      try
      {

getAttributeScopeListener(theObject).attributesInScope(theObject,
theAttributes);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   attributesOutOfScope(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      try
      {
getAttributeScopeListener(theObject).attributesOutOfScope(theObject,
theAttributes);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorAttributeScopeAdvisoryServer part

   private FederateAmbassadorAttributeScopeAdvisoryServer
   getAttributeScopeResponder(
      ObjectInstanceHandle theObject)
   {
      Object listener = attributeScopeResponders.get(theObject);
      //Fall-through to Class level?
      try
      {
         if (null==listener) listener =
attributeScopeResponders.get(_rti.getKnownObjectClassHandle(theObject)
);
         //Fall-through to default handler?
         if (null==listener) listener =
attributeScopeResponders.get(null);
         //Otherwise, give up
         if (null==listener) return null;
         return
(FederateAmbassadorAttributeScopeAdvisoryServer)listener;
      }
      //ObjectInstanceNotKnown, etc. can't happen
      catch (RTIexception ignored) { return null; }
   }
   public void
   turnUpdatesOnForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      try
      {
getAttributeScopeResponder(theObject).turnUpdatesOnForObjectInstance(t
heObject, theAttributes);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   turnUpdatesOffForObjectInstance(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      try
      {
getAttributeScopeResponder(theObject).turnUpdatesOffForObjectInstance(
theObject, theAttributes);
      }
      catch (NullPointerException ignored) {}
   }
   //FederateAmbassadorAttributeUpdateClient part

   private FederateAmbassadorAttributeUpdateClient
   getAttributeUpdateListener(
      ObjectInstanceHandle theObject)
   {
      Object listener = attributeUpdateListeners.get(theObject);
      //Fall-through to Class level?
      try
      {
         if (null==listener) listener =
attributeUpdateListeners.get(_rti.getKnownObjectClassHandle(theObject)
);
         //Fall-through to default handler?
         if (null==listener) listener =
attributeUpdateListeners.get(null);
         //Otherwise, give up
         if (null==listener) return null;
         return (FederateAmbassadorAttributeUpdateClient)listener;
      }
      //ObjectInstanceNotKnown, etc. can't happen
      catch (RTIexception ignored) { return null; }
   }

   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      try
      {

getAttributeUpdateListener(theObject).reflectAttributeValues(theObject
, theAttributes, userSuppliedTag, sentOrdering, theTransport);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      try
      {
getAttributeUpdateListener(theObject).reflectAttributeValues(theObject
, theAttributes, userSuppliedTag, sentOrdering, theTransport,
sentRegions);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      try
      {
getAttributeUpdateListener(theObject).reflectAttributeValues(theObject
, theAttributes, userSuppliedTag, sentOrdering, theTransport, theTime,
receivedOrdering);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          FederateInternalError
   {
      try
      {

getAttributeUpdateListener(theObject).reflectAttributeValues(theObject
, theAttributes, userSuppliedTag, sentOrdering, theTransport, theTime,
receivedOrdering, sentRegions);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      try
      {

getAttributeUpdateListener(theObject).reflectAttributeValues(theObject
, theAttributes, userSuppliedTag, sentOrdering, theTransport, theTime,
receivedOrdering, retractionHandle);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   reflectAttributeValues(
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle,
      RegionHandleSet         sentRegions)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      try
      {

getAttributeUpdateListener(theObject).reflectAttributeValues(theObject
, theAttributes, userSuppliedTag, sentOrdering, theTransport, theTime,
receivedOrdering, retractionHandle, sentRegions);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorAttributeUpdateServer part

   private FederateAmbassadorAttributeUpdateServer
   getAttributeUpdateResponder(
      ObjectInstanceHandle theObject)
   {
      Object listener = attributeUpdateResponders.get(theObject);
      //Fall-through to Class level?
      try
      {
         if (null==listener) listener =
attributeUpdateResponders.get(_rti.getKnownObjectClassHandle(theObject
));
         //Fall-through to default handler?
         if (null==listener) listener =
attributeUpdateResponders.get(null);
         //Otherwise, give up
         if (null==listener) return null;
         return (FederateAmbassadorAttributeUpdateServer)listener;
      }
      //ObjectInstanceNotKnown, etc. can't happen
      catch (RTIexception ignored) { return null; }
   }
   public void
   provideAttributeValueUpdate(
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   throws ObjectInstanceNotKnown,
          AttributeNotRecognized,
          AttributeNotOwned,
          FederateInternalError
   {
      try
      {

getAttributeUpdateResponder(theObject).provideAttributeValueUpdate(the
Object, theAttributes, userSuppliedTag);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorObjectDiscovery part

   private FederateAmbassadorObjectDiscovery
   getDiscoveryListener(
      ObjectClassHandle theObjectClass)
   {
      Object listener = discoveryListeners.get(theObjectClass);
      //Fall-through to default handler?
      if (null==listener) listener = discoveryListeners.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorObjectDiscovery)listener;
   }

   public void
   discoverObjectInstance(
      ObjectInstanceHandle theObject,
      ObjectClassHandle    theObjectClass,
      String               objectName)
   throws CouldNotDiscover,
          ObjectClassNotRecognized,
          FederateInternalError
   {
      try
      {

getDiscoveryListener(theObjectClass).discoverObjectInstance(theObject,
theObjectClass, objectName);
      }
      catch (NullPointerException ignored) {}
   }
   //FederateAmbassadorObjectRemoval part

   private FederateAmbassadorObjectRemoval
   getRemovalResponder(
      ObjectInstanceHandle theObject)
   {
      Object listener = removalResponders.get(theObject);
      //Fall-through to Class level?
      try
      {
         if (null==listener) listener =
removalResponders.get(_rti.getKnownObjectClassHandle(theObject));
         //Fall-through to default handler?
         if (null==listener) listener = removalResponders.get(null);
         //Otherwise, give up
         if (null==listener) return null;
         return (FederateAmbassadorObjectRemoval)listener;
      }
      //ObjectInstanceNotKnown, etc. can't happen
      catch (RTIexception ignored) { return null; }
   }

   public void
   removeObjectInstance(
      ObjectInstanceHandle theObject,
      byte[]               userSuppliedTag,
      OrderType            sentOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError
   {
      try
      {

getRemovalResponder(theObject).removeObjectInstance(theObject,
userSuppliedTag, sentOrdering);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   removeObjectInstance(
   ObjectInstanceHandle theObject,
      byte[]            userSuppliedTag,
      OrderType         sentOrdering,
      LogicalTime       theTime,
      OrderType         receivedOrdering)
   throws ObjectInstanceNotKnown,
          FederateInternalError
   {
      try
      {

getRemovalResponder(theObject).removeObjectInstance(theObject,
userSuppliedTag, sentOrdering, theTime, receivedOrdering);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   removeObjectInstance(
      ObjectInstanceHandle    theObject,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   throws ObjectInstanceNotKnown,
          InvalidLogicalTime,
          FederateInternalError
   {
      try
      {

getRemovalResponder(theObject).removeObjectInstance(theObject,
userSuppliedTag, sentOrdering, theTime, receivedOrdering,
retractionHandle);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorRestore part

   private FederateAmbassadorRestore
   getFederationRestoreListener()
   {
      Object listener = federationRestoreListeners.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorRestore)listener;
   }

   public void
   requestFederationRestoreSucceeded(
      String label)
   throws FederateInternalError
   {
      try
      {

getFederationRestoreListener().requestFederationRestoreSucceeded(label
);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   requestFederationRestoreFailed(
      String label)
   throws FederateInternalError
   {
      try
      {
getFederationRestoreListener().requestFederationRestoreFailed(label);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   federationRestoreBegun()
   throws FederateInternalError
   {
      try
      {
         getFederationRestoreListener().federationRestoreBegun();
      }
      catch (NullPointerException ignored) {}
   }

   public void
   initiateFederateRestore(
      String         label,
      FederateHandle federateHandle)
   throws SpecifiedSaveLabelDoesNotExist,
          CouldNotInitiateRestore,
          FederateInternalError
   {
      try
      {
         getFederationRestoreListener().initiateFederateRestore(label,
federateHandle);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   federationRestored()
   throws FederateInternalError
   {
      try
      {
         getFederationRestoreListener().federationRestored();
      }
      catch (NullPointerException ignored) {}
   }
   public void
   federationNotRestored(
      RestoreFailureReason reason)
   throws FederateInternalError
   {
      try
      {
         getFederationRestoreListener().federationNotRestored(reason);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   federationRestoreStatusResponse(
      FederateHandleRestoreStatusPair[] response)
   throws FederateInternalError
   {
      try
      {

getFederationRestoreListener().federationRestoreStatusResponse(respons
e);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorSave part

   private FederateAmbassadorSave
   getFederationSaveListener()
   {
      Object listener = federationSaveListeners.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorSave)listener;
   }

   public void
   initiateFederateSave(
      String label)
   throws UnableToPerformSave,
          FederateInternalError
   {
      try
      {
         getFederationSaveListener().initiateFederateSave(label);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   initiateFederateSave(
      String      label,
      LogicalTime time)
   throws InvalidLogicalTime,
          UnableToPerformSave,
          FederateInternalError
   {
      try
      {
         getFederationSaveListener().initiateFederateSave(label,
time);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   federationSaved()
   throws FederateInternalError
   {
      try
      {
         getFederationSaveListener().federationSaved();
      }
      catch (NullPointerException ignored) {}
   }

   public void
   federationNotSaved(
      SaveFailureReason reason)
   throws FederateInternalError
   {
      try
      {
         getFederationSaveListener().federationNotSaved(reason);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   federationSaveStatusResponse(
      FederateHandleSaveStatusPair[] response)
   throws FederateInternalError
   {
      try
      {

getFederationSaveListener().federationSaveStatusResponse(response);
      }
      catch (NullPointerException ignored) {}
   }
   //FederateAmbassadorSynchronization part

   private FederateAmbassadorSynchronization
   getFederationSynchronizationListener(
      String synchronizationPointLabel)
   {
      Object listener =
federationSynchronizationListeners.get(synchronizationPointLabel);
      //Fall-through to default handler?
      if (null==listener) listener =
federationSynchronizationListeners.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorSynchronization)listener;
   }

   public void
   synchronizationPointRegistrationSucceeded(
      String synchronizationPointLabel)
   throws FederateInternalError
   {
      try
      {

getFederationSynchronizationListener(synchronizationPointLabel).synchr
onizationPointRegistrationSucceeded(synchronizationPointLabel);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   synchronizationPointRegistrationFailed(
      String                            synchronizationPointLabel,
      SynchronizationPointFailureReason reason)
   throws FederateInternalError
   {
      try
      {

getFederationSynchronizationListener(synchronizationPointLabel).synchr
onizationPointRegistrationFailed(synchronizationPointLabel, reason);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   announceSynchronizationPoint(
      String synchronizationPointLabel,
      byte[] userSuppliedTag)
   throws FederateInternalError
   {
      try
      {
getFederationSynchronizationListener(synchronizationPointLabel).announ
ceSynchronizationPoint(synchronizationPointLabel, userSuppliedTag);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   federationSynchronized(
      String synchronizationPointLabel)
   throws FederateInternalError
   {
      try
      {
getFederationSynchronizationListener(synchronizationPointLabel).federa
tionSynchronized(synchronizationPointLabel);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorInteractionAdvisory part

   private FederateAmbassadorInteractionAdvisory
   getInteractionAdvisoryResponder(
      InteractionClassHandle interactionClass)
   {
      Object listener =
interactionAdvisoryResponders.get(interactionClass);
      //Fall-through to default handler?
      if (null==listener) listener =
interactionAdvisoryResponders.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorInteractionAdvisory)listener;
   }
   public void
   turnInteractionsOn(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError
   {
      try
      {
getInteractionAdvisoryResponder(theHandle).turnInteractionsOn(theHandl
e);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   turnInteractionsOff(
      InteractionClassHandle theHandle)
   throws InteractionClassNotPublished,
          FederateInternalError
   {
      try
      {
getInteractionAdvisoryResponder(theHandle).turnInteractionsOff(theHand
le);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorInteractionOccurrence part

   private FederateAmbassadorInteractionOccurrence
   getInteractionListener(
      InteractionClassHandle interactionClass)
   {
      Object listener = interactionListeners.get(interactionClass);
      //Fall-through to default handler?
      if (null==listener) listener = interactionListeners.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorInteractionOccurrence)listener;
   }
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      try
      {

getInteractionListener(interactionClass).receiveInteraction(interactio
nClass, theParameters, userSuppliedTag, sentOrdering, theTransport);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      try
      {

getInteractionListener(interactionClass).receiveInteraction(interactio
nClass, theParameters, userSuppliedTag, sentOrdering, theTransport,
sentRegions);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      try
      {
getInteractionListener(interactionClass).receiveInteraction(interactio
nClass, theParameters, userSuppliedTag, sentOrdering, theTransport,
theTime, receivedOrdering);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          FederateInternalError
   {
      try
      {
getInteractionListener(interactionClass).receiveInteraction(interactio
nClass, theParameters, userSuppliedTag, sentOrdering, theTransport,
theTime, receivedOrdering, sentRegions);
      }
      catch (NullPointerException ignored) {}
   }
   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      try
      {

getInteractionListener(interactionClass).receiveInteraction(interactio
nClass, theParameters, userSuppliedTag, sentOrdering, theTransport,
theTime, receivedOrdering, messageRetractionHandle);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   receiveInteraction(
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle,
      RegionHandleSet         sentRegions)
   throws InteractionClassNotRecognized,
          InteractionParameterNotRecognized,
          InteractionClassNotSubscribed,
          InvalidLogicalTime,
          FederateInternalError
   {
      try
      {

getInteractionListener(interactionClass).receiveInteraction(interactio
nClass, theParameters, userSuppliedTag, sentOrdering, theTransport,
theTime, receivedOrdering, messageRetractionHandle, sentRegions);
      }
      catch (NullPointerException ignored) {}
   }
   //FederateAmbassadorNameReservation part

   private FederateAmbassadorNameReservation
   getNameReservationListener(
      String objectName)
   {
      Object listener = nameReservationListeners.get(objectName);
      //Fall-through to default handler?
      if (null==listener) listener =
nameReservationListeners.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorNameReservation)listener;
   }

   public void
   objectInstanceNameReservationSucceeded(
      String objectName)
   throws UnknownName,
          FederateInternalError
   {
      try
      {

getNameReservationListener(objectName).objectInstanceNameReservationSu
cceeded(objectName);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   objectInstanceNameReservationFailed(
      String objectName)
   throws UnknownName,
          FederateInternalError
   {
      try
      {

getNameReservationListener(objectName).objectInstanceNameReservationFa
iled(objectName);
      }
      catch (NullPointerException ignored) {}
   }
   //FederateAmbassadorObjectRegistrationAdvisory part

   private FederateAmbassadorObjectRegistrationAdvisory
   getRegistrationResponder(
      ObjectClassHandle theClass)
   {
      Object listener = registrationResponders.get(theClass);
      //Fall-through to default handler?
      if (null==listener) listener = registrationResponders.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorObjectRegistrationAdvisory)listener;
   }

   public void
   startRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError
   {
      try
      {

getRegistrationResponder(theClass).startRegistrationForObjectClass(the
Class);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   stopRegistrationForObjectClass(
      ObjectClassHandle theClass)
   throws ObjectClassNotPublished,
          FederateInternalError
   {
      try
      {

getRegistrationResponder(theClass).stopRegistrationForObjectClass(theC
lass);
      }
      catch (NullPointerException ignored) {}
   }

   //FederateAmbassadorTime part

   private FederateAmbassadorTime
   getTimeListener()
   {
      Object listener = timeListeners.get(null);
      //Otherwise, give up
      if (null==listener) return null;
      return (FederateAmbassadorTime)listener;
   }
   public void
   timeRegulationEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeRegulationWasPending,
          FederateInternalError
   {
      try
      {
         getTimeListener().timeRegulationEnabled(time);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   timeConstrainedEnabled(
      LogicalTime time)
   throws InvalidLogicalTime,
          NoRequestToEnableTimeConstrainedWasPending,
          FederateInternalError
   {
      try
      {
         getTimeListener().timeConstrainedEnabled(time);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   timeAdvanceGrant(
      LogicalTime theTime)
   throws InvalidLogicalTime,
          JoinedFederateIsNotInTimeAdvancingState,
          FederateInternalError
   {
      try
      {
         getTimeListener().timeAdvanceGrant(theTime);
      }
      catch (NullPointerException ignored) {}
   }

   public void
   requestRetraction(
      MessageRetractionHandle theHandle)
   throws FederateInternalError
   {
      try
      {
         getTimeListener().requestRetraction(theHandle);
      }
      catch (NullPointerException ignored) {}
   }
}
//end FedAmbWrapper
```

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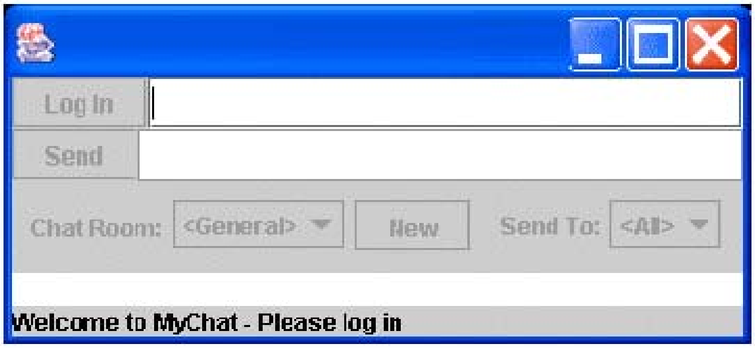
Annex E – The Java Chat Client

The Java Chat Client is a graphical user-interface (GUI) application. A single window is used, with various context-sensitive controls.

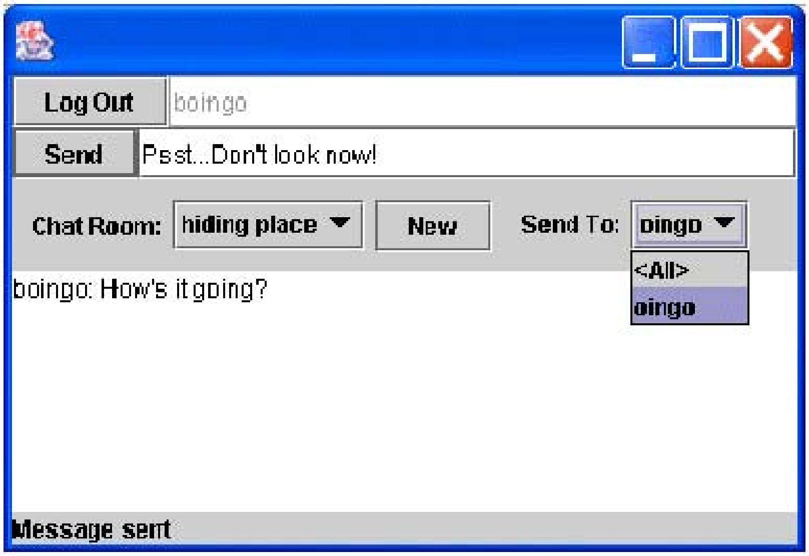


Chat Room: <General>

Send To: <All>

Welcome to MyChat - Please log in

Figure 30. *The Java Chat client in the disconnected state*
The Log In button is enabled only when the text box beside is not empty.
The remaining controls are disabled.



boingo

Psst...Don't look now!

Chat Room: hiding place

Send To: oingo

boingo: How's it going?

Message sent

Figure 31. *The Java Chat client in the joined state*
The text box beside the Log Out button is disabled.
The Send button is enabled only when the text box beside is not empty.

The `ChatRoomRegistryEntries` class implements the HLA ChatRoomRegistry's list attribute object datatype (an `HLAvariableArrayType` of `ChatRoomRegistryEntry`).

```
// File: ChatRoomRegistryEntries.java

package chat;

import hla.rti1516.CouldNotDecode;
import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import java.util.Collection;

/**
 * A type-safe HLAvariableArrayType used by the ChatRoomRegistry
object.
 * It uses <code>ChatRoomRegistryEntry</code> elements.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.0
 */
public class
ChatRoomRegistryEntries
   extends HLAobjectArray
{
   /** Octet boundary of this class. */
   //Although not necessary, declaring this is more efficient
   public final static int
   octetBoundary = HLAinteger32BE.octetBoundary;
//ChatRoomRegistryEntry.octetBoundary;
   //Since ChatRoomRegistryEntry consists of
   // - an HLAunicodeString (a variable array type, of octetBoundary 4
for the count and 2 for the HLAunicodeChar) and
   // - an HLAinteger16BE (octetBoundary 2)

   /**
    * Constructs an empty <code>ChatRoomRegistryEntries</code>.
    */
   public
   ChatRoomRegistryEntries()
   {
      super();
   }
   /**
    * Constructs <code>this</code> from the specified Collection.
    * An exception occurs if the Collection doesn't return a series of
element-compatible objects.
    * @param c a Collection specifying <code>this</code>' value
    */
   public
   ChatRoomRegistryEntries(Collection c)
   //The only reason this isn't in AbstractList already is because of
the constructor signature
   {
      super(c);
   }

   /**
    * Constructs <code>this</code> from the specified Object (a
single-element array).
    * @param o an element-compatible Object specifying
<code>this</code>' first value
    */
   public
   ChatRoomRegistryEntries(Object o)
   {
      super(o);
   }

   /**
    * Creates an <code>ChatRoomRegistryEntries</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>ChatRoomRegistryEntries</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   ChatRoomRegistryEntries(byte[] buffer)
      throws CouldNotDecode
   {
      super(buffer);
   }
   /**
    * Creates an <code>ChatRoomRegistryEntries</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>ChatRoomRegistryEntries</code>
    * @param offset where in the <code>buffer</code> the
<code>ChatRoomRegistryEntries</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   ChatRoomRegistryEntries(byte[] buffer,
                           int    offset)
      throws CouldNotDecode
   {
      super(buffer, offset);
   }

   /**
    * Creates an <code>ChatRoomRegistryEntries</code> from the
supplied <code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>ChatRoomRegistryEntries</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   ChatRoomRegistryEntries(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      super(byteWrapper);
   }

   //HLAarraydatatype interface implementation

   /**
    * Returns the Class of the array's elements.
    * @return the Class of the array's elements
    */
   public Class
   getElementClass()
   {
      return ChatRoomRegistryEntry.class;
   }
}
//end ChatRoomRegistryEntries
```

The `ChatRoomRegistryEntry` class implements the HLA ChatRoomRegistryEntry fixed record datatype.

```
// File: ChatRoomRegistryEntry.java

package chat;

import hla.rti1516.CouldNotDecode;
import ca.gc.drdc_rddc.hla.rti1516.omt.*;

/*
 * A type-safe HLAfixedRecordType used by the ChatRoomRegistryEntries
type.
 * It consists of two fields, an HLAunicodeString name and an
HLAinteger16BE slot.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.0
 */
public class
ChatRoomRegistryEntry
   extends HLAfixedRecordType
{
   //The first field's count; the HLAunicodeString elements
(HLAunicodeChar)
   //and the HLAinteger16BE field have an octetBoundary of 2 each
   public static final int
   octetBoundary = HLAinteger32BE.octetBoundary;
   //The fields that make up our record:
   public HLAunicodeString name;
   public HLAinteger16BE   slot;

   /**
    * Constructs a <code>ChatRoomRegistryEntry</code> of default
values.
    */
   public
   ChatRoomRegistryEntry()
      throws CouldNotDecode
   {
      try
      {
         initializeFields();
      }
      catch (InstantiationException e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   /**
    * Creates a <code>ChatRoomRegistryEntry</code> from the specified
field values.
    * @param aName an HLAunicodeString to copy into the
<code>name</code> field
    * @param aSlot an HLAinteger16BE to copy into the
<code>slot</code> field
    * @throws CouldNotDecode if somethings goes wrong
    */
   public
   ChatRoomRegistryEntry(HLAunicodeString aName,
                         HLAinteger16BE   aSlot)
      throws CouldNotDecode
   {
      this();
      name.setValue(aName.getValue());
      slot.setValue(aSlot.getValue());
   }

   /**
    * Creates a <code>ChatRoomRegistryEntry</code> from the specified
field values.
    * @param aName a String to copy into the <code>name</code> field
    * @param aSlot an HLAinteger16BE to copy into the
<code>slot</code> field
    * @throws CouldNotDecode if somethings goes wrong
    */
   public
   ChatRoomRegistryEntry(String         aName,
                         HLAinteger16BE aSlot)
      throws CouldNotDecode
   {
      this();
      name.setValue(aName);
      slot.setValue(aSlot.getValue());
   }

   /**
    * Creates a <code>ChatRoomRegistryEntry</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>ChatRoomRegistryEntry</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   ChatRoomRegistryEntry(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }
   /**
    * Creates a <code>ChatRoomRegistryEntry</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>ChatRoomRegistryEntry</code>
    * @param offset where in the <code>buffer</code> the
<code>ChatRoomRegistryEntry</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   ChatRoomRegistryEntry(byte[] buffer,
                         int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }

   /**
    * Creates a <code>ChatRoomRegistryEntry</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the
<code>ChatRoomRegistryEntry</code> begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   ChatRoomRegistryEntry(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }
   /**
    * Creates a <code>ChatRoomRegistryEntry</code> from the provided
<code>Map</code>.
    * The <code>Map</code> is specified as mapping String keys
(representing the field names) to their values
(<code>HLAdatatype</code> implementations).
    * The map <code>size()</code> will be unchanging, since the record
will always have the same fields in the same order.
    * Values may not be <code>null</code> since they all must be HLA
data types (i.e. all references will exist).
    * @param theMap the <code>Map</code> representation of the
<code>ChatRoomRegistryEntry</code>
    * @throws CouldNotDecode if the <code>Map</code> could not be
decoded
    */
   public
   ChatRoomRegistryEntry(java.util.Map theMap)
      throws CouldNotDecode
   {
      this();
      try
      {
         putAll(theMap);
      }
      //Wrap all exceptions as CouldNotDecode
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
}
//end ChatRoomRegistryEntry
```

The `Participant` class implements the HLA Participant fixed record datatype.

```
// File: Participant.java

package chat;

import hla.rti1516.CouldNotDecode;
import ca.gc.drdc_rddc.hla.rti1516.omt.*;

/*
 * A type-safe HLAfixedRecordType used to represent a Participant
object.
 * It consists of three fields, an HLAboolean logged_in, an
HLAinteger32BE user_handle and an HLAinteger16BE chat_room_slot.
 * @author  {@link mailto:Daniel.Thibault@DRDC-RDDC.gc.ca Daniel U.
Thibault} ({@link http://www.valcartier.drdc-rddc.gc.ca DRDC
Valcartier})
 * @version 1.0
 */
public class
Participant
   extends HLAfixedRecordType
{
   public static final int
   octetBoundary = HLAinteger32BE.octetBoundary; //4

   //The fields that make up our record:
   public HLAboolean     logged_in;
   public HLAinteger32BE user_handle;
   public HLAinteger16BE chat_room_slot;

   /**
    * Constructs a <code>Participant</code> of default values.
    */
   public
   Participant()
      throws CouldNotDecode
   {
      try
      {
         initializeFields();
      }
      catch (InstantiationException e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
   /**
    * Creates a <code>Participant</code> from the specified field
values.
    * @param aLoggedIn an HLAboolean to copy into the
<code>logged_in</code> field
    * @param aUserHandle an HLAinteger16BE to copy into the
<code>user_handle</code> field
    * @param aChatRoomSlot an HLAinteger16BE to copy into the
<code>chat_room_slot</code> field
    * @throws CouldNotDecode if somethings goes wrong
    */
   public
   Participant(HLAboolean     aLoggedIn,
               HLAinteger32BE aUserhandle,
               HLAinteger16BE aChatRoomSlot)
      throws CouldNotDecode
   {
      this();
      logged_in.setValue(aLoggedIn.getValue());
      user_handle.setValue(aUserhandle.getValue());
      chat_room_slot.setValue(aChatRoomSlot.getValue());
   }

   /**
    * Creates a <code>Participant</code> from the network
representation in the provided <code>byte[]</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>Participant</code>
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   Participant(byte[] buffer)
      throws CouldNotDecode
   {
      this(buffer, 0);
   }

   /**
    * Creates a <code>Participant</code> from the network
representation in the provided <code>byte[]</code> at the indicated
<code>offset</code>.
    * @param buffer the network-provided <code>byte[]</code>
representation of the <code>Participant</code>
    * @param offset where in the <code>buffer</code> the
<code>Participant</code> representation begins
    * @throws CouldNotDecode if the <code>buffer</code> could not be
decoded
    */
   public
   Participant(byte[] buffer,
               int    offset)
      throws CouldNotDecode
   {
      this(new ByteWrapper(buffer, offset));
   }
   /**
    * Creates a <code>Participant</code> from the supplied
<code>ByteWrapper</code>.
    * @param byteWrapper the <code>ByteWrapper</code> at whose current
<code>pos()</code> the representation of the <code>Participant</code>
begins
    * @throws CouldNotDecode if the <code>ByteWrapper</code> could not
be decoded
    */
   public
   Participant(ByteWrapper byteWrapper)
      throws CouldNotDecode
   {
      this();
      decode(byteWrapper);
   }

   /**
    * Creates a <code>Participant</code> from the provided
<code>Map</code>.
    * The <code>Map</code> is specified as mapping String keys
(representing the field names) to their values
(<code>HLAdatatype</code> implementations).
    * The map <code>size()</code> will be unchanging, since the record
will always have the same fields in the same order.
    * Values may not be <code>null</code> since they all must be HLA
data types (i.e. all references will exist).
    * @param theMap the <code>Map</code> representation of the
<code>Participant</code>
    * @throws CouldNotDecode if the <code>Map</code> could not be
decoded
    */
   public
   Participant(java.util.Map theMap)
      throws CouldNotDecode
   {
      this();
      try
      {
         putAll(theMap);
      }
      //Wrap all exceptions as CouldNotDecode
      catch (Exception e)
      {
         CouldNotDecode cnd = new CouldNotDecode(e.getMessage());
         throw (CouldNotDecode)cnd.initCause(e);
      }
   }
}
//end Participant
```

The MyChat class implements the Java HLA Chat Client. This is a large class in part because it contains a multitude of inner classes. It was mostly developed using the (free) NetBeans 3 integrated development environment (IDE), which makes navigating the code in object view fairly easy and efficient. The comments which NetBeans inserts to recognise its own protected (user read-only) blocks have been removed in order to make the source more legible.

```
// File: MyChat.java

package chat;

import java.io.File;
import java.util.HashMap;
//Needed to iterate through the Interaction key set:
import java.util.Iterator;
//Event-handling thread utilities
import javax.swing.SwingUtilities;
//HLA interfaces and normative classes
import hla.rti1516.*;
//The RTI implemented class
import se.pitch.prti1516.RTI;
//Our encoder facilities
import ca.gc.drdc_rddc.hla.rti1516.omt.*;
//Our FedAmbWrapper
import ca.gc.drdc_rddc.hla.rti1516.FedAmb.*;

/**
 * A Chat client that uses the HLA IEEE 1516 RTI as its backbone.
 * Demonstrates Interactions, Objects, and Data Distribution
 * Management.
 * <p>
 * Although the ConcurrentAccess exception from 1.3 is no more,
 * IEEE 1516 will throw "RTIinternalError: Concurrent access
 * attempted to <method name>" if the RTIambassador is invoked
 * from the Federate service thread --but only for certain
 * services (unlike 1.3).  getObjectInstanceName and
 * getAttributeHandleValueMapFactory won't throw the exception,
 * for example.
 * <p>
 * The Chat client joins the federation right away, sets up
 * listeners and responders, and publishes and subscribes to
 * objects and interactions.
 * <p>
 * At first, it was thought to have the federate refrain from
 * subscribing until it logs on, but it became clear that, far
 * from diminishing message traffic, the added complexity of
 * managing known/unknown objects, up-to-date and out-dated
 * reflections, ownership negotiations and so on could in fact
 * increase traffic under certain conditions, and certainly made
 * the multi-threaded program hellishly difficult to design and
 * debug.
 * <p>
 * The federation has one unique object, named
 * "_ChatRoomRegistry", of the ChatRoomRegistry class.  This
 * object has one attribute, "list", which is an HLAvariableArray
 * of ChatRoomRegistryEntry objects, themselves of type
 * HLAfixedRecord.  These have two fields, "name"
 * (HLAunicodeString) and "slot" (HLAinteger16BE). The
 * ChatRoomRegistry's purpose is to assign a unique slot to each
 * ChatRoom object (see below) when it is created. The list keeps
 * track of all extant ChatRooms, and can be used by a ChatRoom
 * creator to ensure the uniqueness of the slot.
 * <p>
 * In circumstances where certain operations are preferred to be
 * performed by only one federate at a time, the ChatRoomRegistry
 * could be used as a "bâton", ownership being passed between
 * federates as a token of their right in performing the
 * operation in question.  This was not used here.
 * <p>
 * The ChatRoom objects are created and deleted as needed by the
 * federates. They have two attributes, "slot" (HLAinteger16BE)
 * and "name" (HLAunicodeString). There are three special
 * ChatRooms:
 * <ul>
 * <li>The "nowhere" ChatRoom is never instantiated and has
 * reserved slot 0. No federate ever subscribes to this region.
 * It is used (through AssociateRegionForUpdates) to temporarily
 * withdraw a Participant object from visibility and thus force
 * advisories to trigger. Participants are constantly associated
 * with the nowhere region. When a Participant switches
 * ChatRooms, it is first unassociated from its current ChatRoom
 * then re-associated with the new one. In between, it remains
 * associated with the nowhere region just to prevent it from
 * reverting to the default region.  Note that I'd rather have
 * used slot -1, but dimensions are specified as running from 0
 * upward, and I did not want to use normalization...
 * </li>
 * <li>The "_waiting_room" is slot 1 and is never deleted. This
 * is where Participants are parked whilst logged out. All
 * federates constantly subscribe to the "_waiting_room".
 * </li>
 * <li>The "_<General>" ChatRoom, finally, has slot 2. It is the
 * ChatRoom every Participant initially logs into.
 * </li>
 * </ul>
 * <p>
 * When a Participant switches ChatRooms or logs out, if the
 * current list of other Participants in the ChatRoom (filtered
 * using the slot) is empty, then the ChatRoom must be deleted.
 * We could delay the inevitable by transferring ownership to
 * some other Participant who happens to be elsewhere;
 * nevertheless, since there'll eventually be a time when there
 * is only one Participant logged into the federation, we might
 * as well delete ChatRooms at that time.  This means that the
 * <General> ChatRoom may be deleted and recreated repeatedly
 * (imagine the lone Participant keeps switching ChatRooms).  For
 * this reason, we do *not* use the HLA name reservation service
 * with ChatRooms (except for the "_waiting_room", which is a
 * fixture); we'll rely on the ChatRoomRegistry for this.
 * <p>
```

```
* User-created ChatRooms have names prefixed with "c", so a user
* could create another "<General>" ("c<General>").
* <p>
* Participant objects, finally, have three attributes:
* "logged_in" (HLAboolean), "user_handle" (HLAinteger32BE) and
* "chat_room_slot" (HLAinteger16BE). Logged_in is redundant,
* since a user is logged-in if his Participant token is in a
* chat_room_slot other than 0 or 1 (a federate may own several
* Participant objects, but only one of them can be elsewhere
* than slots 0 or 1). We use the name reservation service to
* ensure the uniqueness of user names. The user_handles are
* associated with a dimension for DDM purposes, allowing private
* messages between users.
* <p>
* When a user requests to log in as a certain name, we attempt
* reservation. If it succeeds, the name is new and the
* correspondingly-named Participant object is created. If it
* fails, the Participant object is either already in use (in
* which case the log-in fails) or is pre-extant but unused (in
* which case we need only acquire it to complete the log-in).
* The Participant objects cannot be deleted once created --the
* name reservation mechanism entails that deletion is
* irrevocable.
* Therefore, ownership of logged-out Participant objects is
* transferred between federates as needed.
* A federate that shuts down must divest any Participants it
* owns (which will perforce all be in the "_waiting_room"). The
* last federate to leave the federation deletes everything.
* <p>
* DDM is used in two ways. The basic way uses the ChatRoomSlots
* dimension, and tracks which Participants are in the same
* ChatRoom as each federate. Normal messaging is within the
* ChatRoom only. The other way is using the UserHandle
* dimension, and allows private messaging between two users.
* Because the interface only shows those Participants in the
* same ChatRoom, private messaging is thus a sub-case, but in
* theory you could send private messages to anyone else in the
* federation.
* <p>
* A federate is in one of three states: logged out, logged in or
* logging in (a transitional state). This is represented by the
* booleans _me_logged_in and _me_logging_in (F, F = logged out;
* T, F = logged in; F, T = logging in; T, T = not possible).
* <p>
* @author  Daniel U. Thibault <Daniel.Thibault@DRDC-RDDC.GC.Ca>
*/
```

```
public class
MyChat
   extends javax.swing.JFrame
   implements java.awt.event.ActionListener,
              javax.swing.event.DocumentListener,
              java.awt.event.WindowListener,
              java.awt.event.ItemListener
{
   private static final int    CRC_PORT                    = 8989;
   private static final String _name_ChatRoomRegistry      =
"_ChatRoomRegistry";
   private static final String _name_nowhere_ChatRoom      =
"_nowhere";
   private static final String _name_waiting_room_ChatRoom =
"_waiting_room";
   private static final String _name_general_ChatRoom      =
"_<General>";
   private static final short _slot_nowhere_ChatRoom       = 0;
   private static final short _slot_waiting_room_ChatRoom  = 1;
   private static final short _slot_general_ChatRoom       = 2;
   private static final short _slot_FirstFreeChatRoomSlot  = 3;

   private String                  _args[];
   private String                  rtiHost = "localhost"; //args[0]
   private String                  fdd     = "D:\\Documents and
Settings\\dthibault\\Mes Documents\\Java Projects\\MyChat.xml";
//args[1]
   private String                  fedex   = "MyChatRoom"; //args[2]
   private String                  fedname = "MyChatter"; //args[3]
   private FederateHandle          _federateHandle;
   private RTIambassador           _rtiAmbassador;
   private FedAmbWrapper           _fedAmbassador;

   private InteractionClassHandle  _ich_Communication;
   private ParameterHandle         _iph_Communication_message;
   private ParameterHandle         _iph_Communication_sender;

   private ObjectClassHandle       _och_ChatRoomRegistry;
   private AttributeHandleSet      _oahs_ChatRoomRegistry;
   private AttributeHandleSet      _oahs_ChatRoomRegistry_forUpdate;
   private AttributeHandle
_oah_ChatRoomRegistry_DeletePrivilege;
   private AttributeHandle         _oah_ChatRoomRegistry_list;
   private AttributeHandleValueMap _oahvm_ChatRoomRegistry;

   private ObjectClassHandle       _och_ChatRoom;
   private AttributeHandleSet      _oahs_ChatRoom;
   private AttributeHandleSet      _oahs_ChatRoom_forUpdate;
   private AttributeHandle         _oah_ChatRoom_DeletePrivilege;
   private AttributeHandle         _oah_ChatRoom_slot;
   private AttributeHandle         _oah_ChatRoom_name;
   private ObjectClassHandle       _och_Participant;
   private AttributeHandleSet      _oahs_Participant;
   private AttributeHandleSet      _oahs_Participant_forUpdate;
   private AttributeHandle         _oah_Participant_DeletePrivilege;
   private AttributeHandle         _oah_Participant_logged_in;
   private AttributeHandle         _oah_Participant_user_handle;
   private AttributeHandle         _oah_Participant_chat_room_slot;

   private DimensionHandle         _dh_UserHandleSlots;
   private DimensionHandleSet      _dhs_UserHandleSlotsSet;
   private DimensionHandle         _dh_ChatRoomSlots;
   private DimensionHandleSet      _dhs_ChatRoomSlotsSet;

   //The handle of the Region matched to "_nowhere" (slot 0)
   private RegionHandle            _rh_nowhere_ChatRoom;
   private RegionHandleSet         _rhs_nowhere_ChatRoom;
   //The handle of the Region matched to the "_waiting_room" ChatRoom
(slot 1)
   private RegionHandle            _rh_waiting_room_ChatRoom;
   private RegionHandleSet         _rhs_waiting_room_ChatRoom;
   //The handle of the Region matched to the "<General>" ChatRoom
(slot 2)
   private RegionHandle            _rh_general_ChatRoom;
   private RegionHandleSet         _rhs_general_ChatRoom;
   //The handle of the Region matched to our current ChatRoom, if any
(null otherwise)
   private RegionHandle            _rh_current_ChatRoom;
   private RegionHandleSet         _rhs_current_ChatRoom;
   //The handle of the Region matched to our current UserHandle, if
any (null otherwise)
   private RegionHandle            _rh_myParticipantRegion;
   private RegionHandleSet         _rhs_myParticipantRegion;
   //The list (size 2) of AttributeSet-RegionSet pairs used for
Participant publish/subscribe
   //The AttributeSet will always be _oahs_Participant_forUpdate;
   //the RegionSet will always be one of _rh_nowhere_ChatRoom,
_rh_waiting_room_ChatRoom or _rh_current_ChatRoom
   private AttributeSetRegionSetPairList _asrspl_Participant_nowhere;
   private AttributeSetRegionSetPairList
_asrspl_Participant_waiting_room;
   private AttributeSetRegionSetPairList _asrspl_Participant_current;

   private Semaphore               _sem_reservation = new Semaphore();
   private Semaphore               _sem_discovery   = new Semaphore();
   private Semaphore               _sem_acquisition = new Semaphore();
   private Semaphore               _sem_divestiture = new Semaphore();

   private boolean                 _me_logged_in     = false;
   private boolean                 _me_logging_in    = false;
   private boolean                 _alone            = true;
   private boolean                 _me_shutting_down = false;

   //To allow user names and chat room names to be anything, the
latter will be prefixed
   //by "p" and "c", respectively, whilst our reserved names will be
prefixed by "_"
```

```
   //The unique ChatRoomRegistry object
   private class
   aChatRoomRegistry
   {
      //Whether we own the object or not
      public boolean
      owned = false;
      //Whether we subscribe to the object class or not
      //(and therefore whether the value is up to date or not)
      public boolean
      subscribed = false;
      //Whether we are divesting the object or not (makes sense only
if owned)
      public boolean
      divesting = false;
      //The ChatRoomRegistry object's name
      final public String
      name = _name_ChatRoomRegistry;
      //The ChatRoomRegistry object's handle
      public ObjectInstanceHandle
      handle = null;
      //The ChatRoomRegistry object's list field
      public ChatRoomRegistryEntries
      list;

      /**
       * Default constructor; the name is unique and the list pre-
loaded with the "waiting_room" and <General>" ChatRooms.
       */
      public
      aChatRoomRegistry()
         throws CouldNotDecode
      {
         list = new ChatRoomRegistryEntries();
         list.add(list.size(), new ChatRoomRegistryEntry(new
HLAunicodeString(_name_waiting_room_ChatRoom), new
HLAinteger16BE(_slot_waiting_room_ChatRoom)));
         list.add(list.size(), new ChatRoomRegistryEntry(new
HLAunicodeString(_name_general_ChatRoom), new
HLAinteger16BE(_slot_general_ChatRoom)));
      }
   }
   private aChatRoomRegistry _ChatRoomRegistry = null;
   //ChatRooms
   private class
   aChatRoom
   {
      //Whether we own the object or not
      public boolean
      owned = false;
      //Whether we subscribe to the object class or not
      //(and therefore whether the value is up to date or not)
      public boolean
      subscribed = false;
      //Whether we are divesting the object or not (makes sense only
if owned)
      public boolean
      divesting = false;
      //The object's handle
      public ObjectInstanceHandle
      handle = null;
      //The ChatRoom object's name field
      public HLAunicodeString
      name;
      //The ChatRoom object's slot field
      public HLAinteger16BE
      slot;

      /**
       * Constructs a chat room of the specified name and slot.
       * @param aName a String specifying the ChatRoom's name field
value
       * @param aSlot a Short specifying the ChatRoom's slot field
value
       */
      public
      aChatRoom(String aName, short aSlot)
      {
         slot = new HLAinteger16BE(aSlot);
         name = new HLAunicodeString(aName);
      }
   }
   //The nowhere_ChatRoom is never instantiated
   //The waiting_room ChatRoom
   final private aChatRoom _waiting_room_ChatRoom = new
aChatRoom(_name_waiting_room_ChatRoom, _slot_waiting_room_ChatRoom);
   //The general ChatRoom
   private aChatRoom _general_ChatRoom; // = new
aChatRoom(_name_general_ChatRoom, _slot_general_ChatRoom);
   //The ChatRoom we're in
   private aChatRoom _myChatRoom;
   //The set of ChatRooms (keys are ObjectInstanceHandle, values are
aChatRoom)
   private HashMap _theChatRooms = new HashMap();
   //Our Participant object
   private class
   aParticipant
   {
      //Whether we own the object or not
      public boolean
      owned = false;
      //Whether we subscribe to the object class or not
      //(and therefore whether the value is up to date or not)
      public boolean
      subscribed = false;
      //Whether we are divesting the object or not (makes sense only
if owned)
      public boolean
      divesting = false;
      //Whether the object is in scope or not (relevant only if owned
is false)
      //(we're forced to do this instead of localDelete)
      public boolean
      inscope = false;
      //The object's handle
      public ObjectInstanceHandle
      handle = null;
      //The object's name
      public HLAunicodeString
      name = new HLAunicodeString();
      //The logged-in field
      private HLAboolean
      logged_in;
      //The user handle field
      private HLAinteger32BE
      user_handle;
      //The current chat room slot field
      private HLAinteger16BE
      chat_room_slot;

      /**
       * Default constructor; the name is empty, logged_in is
HLAfalse,
       * user_handle is 0 and chat_room_slot is 0 (nowhere).
       */
      public
      aParticipant()
      {
         logged_in = new HLAboolean(false);
         user_handle = new HLAinteger32BE(0);
         chat_room_slot = new HLAinteger16BE(_slot_nowhere_ChatRoom);
      }
   }
   private aParticipant _me = new aParticipant();
   //List of known Participants (including ourselves); keys are
ObjectInstanceHandles, values are aParticipant objects
   private HashMap _theParticipants = new HashMap();
   /** Creates new form MyChat */
   public MyChat(String args[])
   {
      //This runs in the main thread ("main")
      _args = args;
      initComponents();
      txtUsername.getDocument().addDocumentListener(this);
      txtMessage.getDocument().addDocumentListener(this);
   }

   /**
    * This method is called from within the constructor to
    * initialize the form.
    * WARNING: Do NOT modify this code. The content of this method is
    * always regenerated by the Form Editor.
    */
   private void initComponents()
   {
      jPanel1 = new javax.swing.JPanel();
      jPanel3 = new javax.swing.JPanel();
      btnLogon = new javax.swing.JButton();
      txtUsername = new javax.swing.JTextField();
      jPanel4 = new javax.swing.JPanel();
      btnSendMessage = new javax.swing.JButton();
      txtMessage = new javax.swing.JTextField();
      jPanel5 = new javax.swing.JPanel();
      jPanel6 = new javax.swing.JPanel();
      lblChatRoom = new javax.swing.JLabel();
      lstChatRooms = new javax.swing.JComboBox();
      btnNewChatRoom = new javax.swing.JButton();
      jPanel7 = new javax.swing.JPanel();
      lblSendTo = new javax.swing.JLabel();
      lstSendTo = new javax.swing.JComboBox();
      txtArea = new javax.swing.JTextArea();
      jPanel2 = new javax.swing.JPanel();
      lblStatus = new javax.swing.JLabel();


setDefaultCloseOperation(javax.swing.WindowConstants.EXIT_ON_CLOSE);
      setFont(new java.awt.Font("Arial", 0, 12));
      setName("frmMyChat");
      addWindowListener(this);

      jPanel1.setLayout(new java.awt.BorderLayout());

      jPanel3.setLayout(new java.awt.BorderLayout());

      btnLogon.setText("Log In");
      btnLogon.setEnabled(false);
      btnLogon.addActionListener(this);

      jPanel3.add(btnLogon, java.awt.BorderLayout.WEST);

      txtUsername.setEnabled(false);
      jPanel3.add(txtUsername, java.awt.BorderLayout.CENTER);

      jPanel1.add(jPanel3, java.awt.BorderLayout.NORTH);
      jPanel4.setLayout(new java.awt.BorderLayout());

      btnSendMessage.setText("Send");
      btnSendMessage.setEnabled(false);
      btnSendMessage.addActionListener(this);

      jPanel4.add(btnSendMessage, java.awt.BorderLayout.WEST);

      txtMessage.setEnabled(false);
      jPanel4.add(txtMessage, java.awt.BorderLayout.CENTER);

      jPanel1.add(jPanel4, java.awt.BorderLayout.CENTER);

      jPanel5.setLayout(new
java.awt.FlowLayout(java.awt.FlowLayout.LEFT));

      jPanel6.setLayout(new
java.awt.FlowLayout(java.awt.FlowLayout.LEFT));

      lblChatRoom.setText("Chat Room:");
      lblChatRoom.setEnabled(false);
      jPanel6.add(lblChatRoom);

      lstChatRooms.setModel(new javax.swing.DefaultComboBoxModel(new
String[] { "<General>" }));
      lstChatRooms.setEnabled(false);
      lstChatRooms.addItemListener(this);

      jPanel6.add(lstChatRooms);

      btnNewChatRoom.setText("New");
      btnNewChatRoom.setActionCommand("NewChatRoom");
      btnNewChatRoom.setEnabled(false);
      btnNewChatRoom.addActionListener(this);

      jPanel6.add(btnNewChatRoom);

      jPanel5.add(jPanel6);

      jPanel7.setLayout(new
java.awt.FlowLayout(java.awt.FlowLayout.LEFT));

      lblSendTo.setText("Send To:");
      lblSendTo.setEnabled(false);
      jPanel7.add(lblSendTo);

      lstSendTo.setModel(new javax.swing.DefaultComboBoxModel(new
String[] { "<All>" }));
      lstSendTo.setEnabled(false);
      jPanel7.add(lstSendTo);

      jPanel5.add(jPanel7);

      jPanel1.add(jPanel5, java.awt.BorderLayout.SOUTH);

      getContentPane().add(jPanel1, java.awt.BorderLayout.NORTH);
      txtArea.setBackground(new java.awt.Color(255, 255, 255));
      txtArea.setEditable(false);
      txtArea.setName("txtArea");
      getContentPane().add(txtArea, java.awt.BorderLayout.CENTER);

      jPanel2.setLayout(new java.awt.BorderLayout());

      lblStatus.setText("MyChat is initialising - Please wait...");
      lblStatus.setName("lblStatus");
      jPanel2.add(lblStatus, java.awt.BorderLayout.SOUTH);

      getContentPane().add(jPanel2, java.awt.BorderLayout.SOUTH);

      pack();
   }

   // Code for dispatching events from components to event handlers.

   public void actionPerformed(java.awt.event.ActionEvent evt)
   {
      if (evt.getSource() == btnLogon)
      {
         MyChat.this.btnLogonActionPerformed(evt);
      }
      else if (evt.getSource() == btnSendMessage)
      {
         MyChat.this.btnSendMessageActionPerformed(evt);
      }
      else if (evt.getSource() == btnNewChatRoom)
      {
         MyChat.this.btnNewChatRoomActionPerformed(evt);
      }
   }

   public void itemStateChanged(java.awt.event.ItemEvent evt)
   {
      if (evt.getSource() == lstChatRooms)
      {
         MyChat.this.lstChatRoomsItemStateChanged(evt);
      }
   }

   public void windowActivated(java.awt.event.WindowEvent evt)
   {
   }

   public void windowClosed(java.awt.event.WindowEvent evt)
   {
   }

   public void windowClosing(java.awt.event.WindowEvent evt)
   {
      if (evt.getSource() == MyChat.this)
      {
         MyChat.this.exitForm(evt);
      }
   }
   public void windowDeactivated(java.awt.event.WindowEvent evt)
   {
   }

   public void windowDeiconified(java.awt.event.WindowEvent evt)
   {
   }

   public void windowIconified(java.awt.event.WindowEvent evt)
   {
   }

   public void windowOpened(java.awt.event.WindowEvent evt)
   {
      if (evt.getSource() == MyChat.this)
      {
         MyChat.this.openForm(evt);
      }
   }

   private void
btnNewChatRoomActionPerformed(java.awt.event.ActionEvent evt)
   {
      //To allow user names and chat room names to be anything, the
latter will be prefixed
      //by "p" and "c", respectively, whilst our reserved names will
be prefixed by "_"
      String newChatRoomName =
javax.swing.JOptionPane.showInputDialog("Enter the new chat room's
name:");
      if (newChatRoomName.equals("")) return;
      synchronized(AcquireChatRoomRegistry())
      {
         aChatRoom _ChatRoom =
AddChatRoomAndUpdateRegistry(newChatRoomName);
         lstChatRooms.addItem(newChatRoomName);
//addItem(_ChatRoom.name.toString().substring(1));
      } //synchronized(AcquireChatRoomRegistry())
      lstChatRooms.setSelectedItem(newChatRoomName);
   }
   private void lstChatRoomsItemStateChanged(java.awt.event.ItemEvent
evt)
   {
      //getItemSelectable //the originator of the event, a
javax.swing.JComboBox
      //getItem //the item affected by the event, a java.lang.String
(or whatever was added to the list)
      if ((!_me_logged_in) || (evt.getStateChange() != evt.SELECTED))
return;
      //Moving to the evt.getItem().toString() ChatRoom
      try {
         String _newChatRoomName;
         if
(((javax.swing.JComboBox)evt.getItemSelectable()).getSelectedIndex()
== 0)
         {
            _newChatRoomName = _name_general_ChatRoom; //"_" +
evt.getItem().toString(); //General ChatRoom
         } else {
            _newChatRoomName = "c" + evt.getItem().toString();
         } //if
         //The change of ChatRooms cannot be from nowhere or
waiting_room; it has
         //to be from an active ChatRoom, including the <General>
ChatRoom.
         _rtiAmbassador.unassociateRegionsForUpdates(_me.handle,
_asrspl_Participant_current);
         //At this point, _me.handle is only associated with
_asrspl_Participant_nowhere

         //Unsubscribe from the current ChatRoom

_rtiAmbassador.unsubscribeInteractionClassWithRegions(_ich_Communicati
on, _rhs_current_ChatRoom);
         //Look at the ChatRoom we're leaving to decide whether to
delete it or not
         int count = 0;
         synchronized(_theParticipants)
         {
            aParticipant _iParticipant;
            for (Iterator i = _theParticipants.values().iterator();
i.hasNext();)
            {
               _iParticipant = (aParticipant)i.next();
               //Out of scope Participants have unreliable attributes;
they cannot be in our ChatRoom in any case
               //The only exceptions are owned Participants: any owned
orphans can only be in the waiting_room
               //_me isn't counted
               if ((!_me.handle.equals(_iParticipant.handle)) &&
                   (_iParticipant.inscope) &&

(_me.chat_room_slot.equals(_iParticipant.chat_room_slot)) ) count++;
            } //for
         } //synchronized(_theParticipants)
         //This'll cause the Participants in our ChatRoom to go out of
scope

_rtiAmbassador.unsubscribeObjectClassAttributesWithRegions(_och_Partic
ipant, _asrspl_Participant_current);

         //What if someone logs into the ChatRoom after we've counted
its Participants but before we actually delete it?

         aChatRoom _previousChatRoom = _myChatRoom;
         if (_newChatRoomName.equals(_name_general_ChatRoom))
         {
            //Does the General ChatRoom exist?
            _general_ChatRoom =
SeekChatRoomBySlot(_slot_general_ChatRoom);
            //General ChatRoom may not be in _theChatRooms, since it
is never explicitly recreated
            if (null == _general_ChatRoom)
            {
               synchronized(AcquireChatRoomRegistry())
               {
                  _general_ChatRoom = new
aChatRoom(_name_general_ChatRoom, _slot_general_ChatRoom);
                  _general_ChatRoom.owned =
_general_ChatRoom.subscribed = true;
//                _general_ChatRoom.divesting = false;
                  synchronized(_theChatRooms)
                  {
                     _theChatRooms.put(_general_ChatRoom.handle =
_rtiAmbassador.registerObjectInstance(_och_ChatRoom),
_general_ChatRoom);
                     //No need to add the General ChatRoom to the
_ChatRoomRegistry, as it is already listed
                  } //synchronized(_theChatRooms)
               } //synchronized(AcquireChatRoomRegistry())
            } //if
            _myChatRoom = _general_ChatRoom;
         } else {
            _myChatRoom = SeekChatRoomByName(_newChatRoomName);
//Cannot fail
         } //if
         //Modify asrspl and delete old region, unless it was the
General ChatRoom
         RegionHandle _rh_previous_ChatRoom = _rh_current_ChatRoom;
//= (RegionHandle)_rhs_current_ChatRoom.toArray()[0];
         _asrspl_Participant_current.remove(0);
         _rhs_current_ChatRoom.remove(_rh_previous_ChatRoom);
         if (!_rh_previous_ChatRoom.equals(_rh_general_ChatRoom))
         {
            _rtiAmbassador.deleteRegion(_rh_previous_ChatRoom);
         } //if
         //New region
         if (_newChatRoomName.equals(_name_general_ChatRoom))
         {
            _rh_current_ChatRoom = _rh_general_ChatRoom;
         } else {
            _rh_current_ChatRoom =
_rtiAmbassador.createRegion(_dhs_ChatRoomSlotsSet);
            _rtiAmbassador.setRangeBounds(_rh_current_ChatRoom,
_dh_ChatRoomSlots, new RangeBounds(_myChatRoom.slot.getValue(), 1 +
_myChatRoom.slot.getValue()));
         } //if
         _rhs_current_ChatRoom.add(_rh_current_ChatRoom);

_rtiAmbassador.commitRegionModifications(_rhs_current_ChatRoom);
//Won't complain if there are no mods to commit
         //Regenerate asrspl
         _asrspl_Participant_current.add(new
AttributeRegionAssociation(_oahs_Participant_forUpdate,
_rhs_current_ChatRoom));
         _me.chat_room_slot.setValue(_myChatRoom.slot.getValue());
         //Go back in
         //This'll reveal the participants in the new ChatRoom

_rtiAmbassador.subscribeObjectClassAttributesWithRegions(_och_Particip
ant, _asrspl_Participant_current);
         //Re-open the communication channel for the new ChatRoom

_rtiAmbassador.subscribeInteractionClassWithRegions(_ich_Communication
, _rhs_current_ChatRoom);
         //Reveal ourselves to the new ChatRoom
         _rtiAmbassador.associateRegionsForUpdates(_me.handle,
_asrspl_Participant_current);
```

```
         //Delete old ChatRoom?
         if (count <= 0) //Should be just ==0 but you never know
(because of inscope, _me isn't counted)
         {
            //We were the only Participant left in the old ChatRoom;
delete it as we leave (we must be the owner, obviously)
            synchronized(AcquireChatRoomRegistry())
            {
               //Because we're the owner, we won't get a
RemoveObjectInstance notification
               //The remove returns the removed value, which is
_previousChatRoom
               synchronized(_theChatRooms)
               {

_rtiAmbassador.deleteObjectInstance(((aChatRoom)_theChatRooms.remove(_
previousChatRoom.handle)).handle, null);
               } //synchronized(_theChatRooms)

RemoveChatRoomAndUpdateRegistry(_previousChatRoom.slot.getValue());
               if
(!_previousChatRoom.name.toString().equals(_name_general_ChatRoom))
               {

lstChatRooms.removeItem(_previousChatRoom.name.toString().substring(1)
);
               } //if
            } //synchronized(AcquireChatRoomRegistry())
         } else if (_previousChatRoom.owned)
         {
            //There are other Participants but we were the owner:
transfer ownership
            _previousChatRoom.divesting = true;

_rtiAmbassador.negotiatedAttributeOwnershipDivestiture(_previousChatRo
om.handle, _oahs_ChatRoom, null);
         } //if
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }

   //Start of DocumentListener implementation and dispatching code
   /**
    * The NetBeans IDE unfortunately does not expose/integrate this
critical bit,
    * so we have to hook it up manually.
    */
   public void changedUpdate(javax.swing.event.DocumentEvent evt)
   {
   }
   public void insertUpdate(javax.swing.event.DocumentEvent evt)
   {
      //This runs in the event-handling thread ("AWT-EventQueue-0")
      if (evt.getDocument().equals(txtUsername.getDocument()))
      {
         MyChat.this.txtUsernameDocumentChanged(evt);
      } else if (evt.getDocument().equals(txtMessage.getDocument()))
      {
         MyChat.this.txtMessageDocumentChanged(evt);
      } //if
   }

   public void removeUpdate(javax.swing.event.DocumentEvent evt)
   {
      if (evt.getDocument().equals(txtUsername.getDocument()))
      {
         MyChat.this.txtUsernameDocumentChanged(evt);
      } else if (evt.getDocument().equals(txtMessage.getDocument()))
      {
         MyChat.this.txtMessageDocumentChanged(evt);
      } //if
   }

   //User-specified handlers
   /**
    * This handler watches the txtUsername's text; the btnLogon is
enabled
    * only when that text is other than the empty string.
    */
   public void
txtUsernameDocumentChanged(javax.swing.event.DocumentEvent evt)
   {
      //This runs in the event-handling thread ("AWT-EventQueue-0")
      // A user name must be specified before btnLogon may be clicked
      if (txtUsername.getText().length() > 0)
      {
         btnLogon.setEnabled(true);
         btnLogon.getRootPane().setDefaultButton(btnLogon);
      } else {
         btnLogon.setEnabled(false);
      } //if
   }
   /**
    * This handler watches the txtMessage's text; the btnSendMessage
    * is enabled only when that text is other than the empty string.
    */
   public void
txtMessageDocumentChanged(javax.swing.event.DocumentEvent evt)
   {
      //This runs in the event-handling thread ("AWT-EventQueue-0")
      // A message must be specified before btnSendMessage may be
clicked
      if (txtMessage.getText().length() > 0)
      {
         btnSendMessage.setEnabled(true);

btnSendMessage.getRootPane().setDefaultButton(btnSendMessage);
      } else {
         btnSendMessage.setEnabled(false);
      } //if
   }

   //End of DocumentListener implementation and dispatching code
   /**
    * Occurs when the window is first opened.
    */
   private void openForm(java.awt.event.WindowEvent evt)
   {
      //This runs in the event-handling thread ("AWT-EventQueue-0")
      lblStatus.setText("MyChat initialising - RTIambassador
obtained");
      new Thread() { public void run() {
         //Join federation
         if (!joinFederation()) return;
         try {
            _ChatRoomRegistry = new aChatRoomRegistry(); //We couldn't
do this in the field declarations because of the escaping Exception
         } catch (CouldNotDecode ignored) {
         } //try
         //The ChatRoomRegistry is created with the "waiting_room" and
"<General>" slots already filled in
         if (!getHandles()) return;
         if (!setupChatRoomRegistry()) return;
         if (!setupChatRooms()) return;
         if (!setupParticipants()) return;
         SwingUtilities.invokeLater(new Runnable() { public void run()
{
            //Remaining initialisation
            try {
               txtUsername.setEnabled(true); //This'll allow btnLogon
to become enabled
               txtUsername.requestFocus();
               lblStatus.setText("Welcome to MyChat - Please log in");
            } catch (Exception e) {
               e.printStackTrace();
            } //try
         } } ); //Runnable
      } }.start(); //Thread
   }
   private boolean
   joinFederation()
   {
      //Runs on a separate thread --not the event dispatch thread
      //Remaining initialisation
      try {
         //Process the command-line arguments
         if (_args.length > 0) rtiHost = _args[0];
         //NetBeans runs this in its root directory, e.g. "C:\Program
Files\j2sdk_nb\netbeans3.6\"
         if (_args.length > 1) fdd     = _args[1];
         if (_args.length > 2) fedex   = _args[2];
         if (_args.length > 3) fedname = _args[3];
         //Get the RTIambassador
         try {
            _rtiAmbassador = RTI.getRTIambassador(rtiHost, CRC_PORT);
         } catch (Exception e) {
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               lblStatus.setText("Unable to connect to CRC on " +
rtiHost + ":" + CRC_PORT);
            } } ); //Runnable
            return false;
         } //try
         SwingUtilities.invokeLater(new Runnable() { public void run()
{
            lblStatus.setText("MyChat initialising - RTIambassador
obtained");
         } } ); //Runnable

         //Get the FederateAmbassador
         //FedAmbWrapper provides a dispatching layer around the
FederateAmbassador itself
         try {
            _fedAmbassador = new FedAmbWrapper(_rtiAmbassador);
         } catch (Exception e) {
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               lblStatus.setText("Unable to create new
FedAmbWrapper");
            } } ); //Runnable
            return false;
         } //try
         SwingUtilities.invokeLater(new Runnable() { public void run()
{
            lblStatus.setText("MyChat initialising - FedAmbassador
obtained");
         } } ); //Runnable
         //Destroy any lingering empty federation execution
         try {
            _rtiAmbassador.destroyFederationExecution(fedex);
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               lblStatus.setText("MyChat initialising - Previous " +
fedex + " federation destroyed");
            } } ); //Runnable
         } catch (FederatesCurrentlyJoined ignored) {
         } catch (FederationExecutionDoesNotExist ignored) {
         } //try

         //Create the federation execution
         final File fddFile = new File(fdd);
         try {
            _rtiAmbassador.createFederationExecution(fedex,
fddFile.toURL());
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               lblStatus.setText("MyChat initialising - " + fedex + "
federation created");
            } } ); //Runnable
         } catch (FederationExecutionAlreadyExists ignored) {
         } catch (CouldNotOpenFDD cnof) {
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               lblStatus.setText("Could not open FDD «" +
fddFile.getAbsoluteFile().toString() + "»");
            } } ); //Runnable
            return false;
         } catch (ErrorReadingFDD erf) {
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               lblStatus.setText("Corrupt FDD «" +
fddFile.getAbsoluteFile().toString() + "»");
            } } ); //Runnable
            return false;
         } //try

         //Join the federation execution
         _federateHandle =
_rtiAmbassador.joinFederationExecution(fedname, fedex, _fedAmbassador,
null);
         SwingUtilities.invokeLater(new Runnable() { public void run()
{
            lblStatus.setText("MyChat initialising - Joined as " +
_federateHandle);
         } } ); //Runnable
         return true;
      } catch (Exception e) {
         e.printStackTrace();
         return false;
      } //try
   }
   private boolean
   getHandles()
   {
      //Runs on a separate thread --not the event dispatch thread
      try {
         //Obtain object/interaction and parameter/attribute handles
         _ich_Communication =
_rtiAmbassador.getInteractionClassHandle("Communication");
         _iph_Communication_message =
_rtiAmbassador.getParameterHandle(_ich_Communication, "message");
         _iph_Communication_sender =
_rtiAmbassador.getParameterHandle(_ich_Communication, "sender");

         _och_ChatRoomRegistry =
_rtiAmbassador.getObjectClassHandle("ChatRoomRegistry");
         _oah_ChatRoomRegistry_DeletePrivilege =
_rtiAmbassador.getAttributeHandle(_och_ChatRoomRegistry,
RTI.PrivilegeToDeleteObjectName); //"HLAprivilegeToDeleteObject");
         _oah_ChatRoomRegistry_list            =
_rtiAmbassador.getAttributeHandle(_och_ChatRoomRegistry, "list");
         //Build the attribute handle sets
         _oahs_ChatRoomRegistry =
_rtiAmbassador.getAttributeHandleSetFactory().create();
         _oahs_ChatRoomRegistry.add(_oah_ChatRoomRegistry_list);

_oahs_ChatRoomRegistry.add(_oah_ChatRoomRegistry_DeletePrivilege);
         _oahs_ChatRoomRegistry_forUpdate =
_rtiAmbassador.getAttributeHandleSetFactory().create();

_oahs_ChatRoomRegistry_forUpdate.add(_oah_ChatRoomRegistry_list);

         _och_ChatRoom =
_rtiAmbassador.getObjectClassHandle("ChatRoom");
         _oah_ChatRoom_DeletePrivilege =
_rtiAmbassador.getAttributeHandle(_och_ChatRoom,
RTI.PrivilegeToDeleteObjectName);
         _oah_ChatRoom_name =
_rtiAmbassador.getAttributeHandle(_och_ChatRoom, "name");
         _oah_ChatRoom_slot =
_rtiAmbassador.getAttributeHandle(_och_ChatRoom, "slot");
         //Build the attribute handle sets
         _oahs_ChatRoom =
_rtiAmbassador.getAttributeHandleSetFactory().create();
         _oahs_ChatRoom.add(_oah_ChatRoom_DeletePrivilege);
         _oahs_ChatRoom.add(_oah_ChatRoom_name);
         _oahs_ChatRoom.add(_oah_ChatRoom_slot);
         _oahs_ChatRoom_forUpdate =
_rtiAmbassador.getAttributeHandleSetFactory().create();
         _oahs_ChatRoom_forUpdate.add(_oah_ChatRoom_name);
         _oahs_ChatRoom_forUpdate.add(_oah_ChatRoom_slot);
         _och_Participant =
_rtiAmbassador.getObjectClassHandle("Participant");
         _oah_Participant_DeletePrivilege =
_rtiAmbassador.getAttributeHandle(_och_Participant,
RTI.PrivilegeToDeleteObjectName);
         _oah_Participant_logged_in       =
_rtiAmbassador.getAttributeHandle(_och_Participant, "logged_in");
         _oah_Participant_user_handle     =
_rtiAmbassador.getAttributeHandle(_och_Participant, "user_handle");
         _oah_Participant_chat_room_slot  =
_rtiAmbassador.getAttributeHandle(_och_Participant, "chat_room_slot");
         //Build the attribute handle sets
         _oahs_Participant =
_rtiAmbassador.getAttributeHandleSetFactory().create();
         _oahs_Participant.add(_oah_Participant_DeletePrivilege);
         _oahs_Participant.add(_oah_Participant_logged_in);
         _oahs_Participant.add(_oah_Participant_user_handle);
         _oahs_Participant.add(_oah_Participant_chat_room_slot);
         _oahs_Participant_forUpdate =
_rtiAmbassador.getAttributeHandleSetFactory().create();
         _oahs_Participant_forUpdate.add(_oah_Participant_logged_in);

_oahs_Participant_forUpdate.add(_oah_Participant_user_handle);

_oahs_Participant_forUpdate.add(_oah_Participant_chat_room_slot);

         _dh_UserHandleSlots =
_rtiAmbassador.getDimensionHandle("UserHandleSlots");
         _dh_ChatRoomSlots   =
_rtiAmbassador.getDimensionHandle("ChatRoomSlots");
         _dhs_UserHandleSlotsSet =
_rtiAmbassador.getDimensionHandleSetFactory().create();
         _dhs_UserHandleSlotsSet.add(_dh_UserHandleSlots);
         _dhs_ChatRoomSlotsSet =
_rtiAmbassador.getDimensionHandleSetFactory().create();
         _dhs_ChatRoomSlotsSet.add(_dh_ChatRoomSlots);

         _rhs_nowhere_ChatRoom =
_rtiAmbassador.getRegionHandleSetFactory().create();
         _rh_nowhere_ChatRoom =
_rtiAmbassador.createRegion(_dhs_ChatRoomSlotsSet);
         //_nowhere_ChatRoom is slot 0
         _rtiAmbassador.setRangeBounds(_rh_nowhere_ChatRoom,
_dh_ChatRoomSlots, new RangeBounds(_slot_nowhere_ChatRoom, 1 +
_slot_nowhere_ChatRoom));
         _rhs_nowhere_ChatRoom.add(_rh_nowhere_ChatRoom);

_rtiAmbassador.commitRegionModifications(_rhs_nowhere_ChatRoom);
```

```
         _rhs_waiting_room_ChatRoom =
_rtiAmbassador.getRegionHandleSetFactory().create();
         _rh_waiting_room_ChatRoom =
_rtiAmbassador.createRegion(_dhs_ChatRoomSlotsSet);
         //_waiting_room_ChatRoom is slot 1
         _rtiAmbassador.setRangeBounds(_rh_waiting_room_ChatRoom,
_dh_ChatRoomSlots, new RangeBounds(_slot_waiting_room_ChatRoom, 1 +
_slot_waiting_room_ChatRoom));
         _rhs_waiting_room_ChatRoom.add(_rh_waiting_room_ChatRoom);

_rtiAmbassador.commitRegionModifications(_rhs_waiting_room_ChatRoom);

         //The General ChatRoom
         _rhs_general_ChatRoom =
_rtiAmbassador.getRegionHandleSetFactory().create();
         _rh_general_ChatRoom =
_rtiAmbassador.createRegion(_dhs_ChatRoomSlotsSet);
         //General ChatRoom is slot 2
         _rtiAmbassador.setRangeBounds(_rh_general_ChatRoom,
_dh_ChatRoomSlots, new RangeBounds(_slot_general_ChatRoom, 1 +
_slot_general_ChatRoom));
         _rhs_general_ChatRoom.add(_rh_general_ChatRoom);

_rtiAmbassador.commitRegionModifications(_rhs_general_ChatRoom);
```

```
//       _rh_current_ChatRoom = null;
//       _rh_myParticipantRegion = null;
         //For chat_room_slot filtering, we associate all "forUpdate"
attributes to _dh_ChatRoomSlots regions
         //We'd get InvalidRegionContext when subscribing if we
included the DeletePrivilege
         _asrspl_Participant_nowhere      =
_rtiAmbassador.getAttributeSetRegionSetPairListFactory().create(1);
         _asrspl_Participant_nowhere.add(     new
AttributeRegionAssociation(_oahs_Participant_forUpdate,
_rhs_nowhere_ChatRoom));
         _asrspl_Participant_waiting_room =
_rtiAmbassador.getAttributeSetRegionSetPairListFactory().create(1);
         _asrspl_Participant_waiting_room.add(new
AttributeRegionAssociation(_oahs_Participant_forUpdate,
_rhs_waiting_room_ChatRoom));
         //There'll be no Communication traffic through the
waiting_room; this is used only to find out
         //(through the Interaction Advisories) whether there are
other federates or not.

_fedAmbassador.setInteractionAdvisoryResponder(_ich_Communication, new
MyCommunicationAdvisoryResponder());
         _fedAmbassador.setInteractionListener(_ich_Communication, new
MyCommunicationInteractionListener());
         _rtiAmbassador.publishInteractionClass(_ich_Communication);

_rtiAmbassador.subscribeInteractionClassWithRegions(_ich_Communication
, _rhs_waiting_room_ChatRoom);
         return true;
      } catch (Exception e) {
         e.printStackTrace();
         return false;
      } //try
   }
   private boolean
   setupChatRoomRegistry()
   {
      try {
         //With all objects, we cannot allow orphans (objects which
have no instances owned by any federate)
         //because they become undiscoverable. Therefore we can expect
ownership of the "common objects"
         //(i.e. the ChatRoomRegistry, the ChatRoom objects and, to a
certain extent, the Participant objects)
         //to flow between the federates as they join and leave the
federation as well as when they require
         //ownership for modification purposes.
         //Thus, for each class we must set up the following services:
discovery, removal, attribute update (listen
         //and respond) and ownership. Whichever federate owns
(temporarily) an object will keep an image of
         //that object, using the aChatRoomRegistry, aChatRoom and
aParticipant objects.

_fedAmbassador.setAttributeUpdateResponder(_och_ChatRoomRegistry, new
MyChatRoomRegistryInstanceAttributeResponder());

_rtiAmbassador.publishObjectClassAttributes(_och_ChatRoomRegistry,
_oahs_ChatRoomRegistry_forUpdate);

_fedAmbassador.setAttributeUpdateListener(_och_ChatRoomRegistry, new
MyChatRoomRegistryInstanceAttributeListener());
         _fedAmbassador.setOwnershipListener(_och_ChatRoomRegistry,
new MyChatRoomRegistryOwnershipListener(null));

         //Get the ChatRoomRegistry, create it if necessary
         // Reserve name
         boolean reservation_succeeded;
         synchronized(_sem_reservation)
         {
            _sem_reservation.value = false;

_fedAmbassador.setNameReservationListener(_name_ChatRoomRegistry, new
MyNameReservationListener(_sem_reservation));

_rtiAmbassador.reserveObjectInstanceName(_name_ChatRoomRegistry);
            // Wait for reservation succeeded/failed
            waitFor(_sem_reservation);

_fedAmbassador.setNameReservationListener(_name_ChatRoomRegistry,
null);
            reservation_succeeded = _sem_reservation.value;
         } //synchronized(_sem_reservation)
         if (reservation_succeeded)
         {
            //Having reserved the name, we know we're the first
federate to reach this point,
            //so we must create the ChatRoomRegistry.
            synchronized(_ChatRoomRegistry)
            {
               _ChatRoomRegistry.owned = _ChatRoomRegistry.subscribed
= true;
//             _ChatRoomRegistry.divesting = false;
               _ChatRoomRegistry.handle =
_rtiAmbassador.registerObjectInstance(_och_ChatRoomRegistry,
_name_ChatRoomRegistry);
               //Update responder is already in place

_rtiAmbassador.subscribeObjectClassAttributes(_och_ChatRoomRegistry,
_oahs_ChatRoomRegistry_forUpdate);
               //Update listener is already in place
            } //synchronized(_ChatRoomRegistry)
         } else {
            //Name reservation failed, which means there is an already
extant instance
            synchronized(_sem_discovery)
            {
               _sem_discovery.value = false;

_fedAmbassador.setDiscoveryListener(_och_ChatRoomRegistry, new
MyChatRoomRegistryDiscoveryListener(_sem_discovery));
               //No removal responder required since the object is
never deleted
               _ChatRoomRegistry.subscribed = true;

_rtiAmbassador.subscribeObjectClassAttributes(_och_ChatRoomRegistry,
_oahs_ChatRoomRegistry_forUpdate);
               //Update listener is already in place
               waitFor(_sem_discovery);

_fedAmbassador.setDiscoveryListener(_och_ChatRoomRegistry, null);
            } //synchronized(_sem_discovery)
         } //if

         return true;
      } catch (Exception e) {
         e.printStackTrace();
         return false;
      } finally {
      } //try
   }
   private boolean
   setupChatRooms()
   {
      try {
         _fedAmbassador.setDiscoveryListener(_och_ChatRoom, new
MyChatRoomDiscoveryListener(null));
         _fedAmbassador.setRemovalResponder(_och_ChatRoom, new
MyChatRoomRemovalResponder());
         _fedAmbassador.setOwnershipListener(_och_ChatRoom, new
MyChatRoomOwnershipListener(null, null));
         _fedAmbassador.setAttributeUpdateListener(_och_ChatRoom, new
MyChatRoomInstanceAttributeListener());
         // Note that if we wanted an instance-specific responder, we
could not put it in place before getting
         // _oh_myChatRoom back from registerObjectInstance or
getObjectInstanceHandle, so we could
         // conceivably miss a provideAttributeValueUpdate request
issued by another federate between the
         // registration and the setting up of the responder --unless
both statements are put in a single synchronized block.
         _fedAmbassador.setAttributeUpdateResponder(_och_ChatRoom, new
MyChatRoomInstanceAttributeResponder());
         _rtiAmbassador.publishObjectClassAttributes(_och_ChatRoom,
_oahs_ChatRoom_forUpdate);

         // Reserve name
         boolean reservation_succeeded;
         synchronized(_sem_reservation)
         {
            _sem_reservation.value = false;

_fedAmbassador.setNameReservationListener(_name_waiting_room_ChatRoom,
new MyNameReservationListener(_sem_reservation));

_rtiAmbassador.reserveObjectInstanceName(_name_waiting_room_ChatRoom);
            // Wait for reservation succeeded/failed
            waitFor(_sem_reservation);

_fedAmbassador.setNameReservationListener(_name_waiting_room_ChatRoom,
null);
            reservation_succeeded = _sem_reservation.value;
         } //synchronized(_sem_reservation)
         if (reservation_succeeded)
         {
            //Having reserved the name, we know we're the first
federate to reach this point,
            //so we must create the ChatRoom
            synchronized(AcquireChatRoomRegistry())
            {
               synchronized(_theChatRooms)
               {
                  _waiting_room_ChatRoom.owned =
_waiting_room_ChatRoom.subscribed = true;
//                _waiting_room_ChatRoom.divesting = false;
                  //Update responder is already in place
                  _theChatRooms.put(_waiting_room_ChatRoom.handle =
_rtiAmbassador.registerObjectInstance(_och_ChatRoom,
_waiting_room_ChatRoom.name.toString()), _waiting_room_ChatRoom);

_rtiAmbassador.subscribeObjectClassAttributes(_och_ChatRoom,
_oahs_ChatRoom_forUpdate);
                  //The waiting_room ChatRoom is already in the
_ChatRoomRegistry, so no need to update it
               } //synchronized(_theChatRooms)
            } //synchronized(AcquireChatRoomRegistry())
         } else {
            //Name reservation failed, which means there is an already
extant instance
            synchronized(_sem_discovery)
            {
               _sem_discovery.value = false;
               _fedAmbassador.setDiscoveryListener(_och_ChatRoom, new
MyChatRoomDiscoveryListener(_sem_discovery));
               //This is the only pre-existing aChatRoom, so we must
set its subscribed property here
               _waiting_room_ChatRoom.subscribed = true;

_rtiAmbassador.subscribeObjectClassAttributes(_och_ChatRoom,
_oahs_ChatRoom_forUpdate);
               //Update listener is already in place
               waitFor(_sem_discovery);
               _fedAmbassador.setDiscoveryListener(_och_ChatRoom, new
MyChatRoomDiscoveryListener(null));
            } //synchronized(_sem_discovery)
         } //if
         //The General ChatRoom may or may not exist initially

         return true;
      } catch (Exception e) {
         e.printStackTrace();
         return false;
      } finally {
      } //try
   }
   private boolean
   setupParticipants()
   {
      try {
         _fedAmbassador.setDiscoveryListener(_och_Participant, new
MyParticipantDiscoveryListener(null, null));
         //These objects are never deleted, so removal is impossible
         //Instead, they go in/out of scope
         _fedAmbassador.setAttributeScopeListener(_och_Participant,
new MyParticipantAttributeScopeListener());
         _fedAmbassador.setOwnershipListener(_och_Participant, new
MyParticipantOwnershipListener(null, null));
         _fedAmbassador.setAttributeUpdateListener(_och_Participant,
new MyParticipantInstanceAttributeListener());
         // Note that if we wanted an instance-specific responder, we
could not put it in place before getting
         // _oih_myParticipant back from registerObjectInstance or
getObjectInstanceHandle, so we could
         // conceivably miss a provideAttributeValueUpdate request
issued by another federate between the
         // registration and the setting up of the responder --unless
both statements are put in a single synchronized block.
         _fedAmbassador.setAttributeUpdateResponder(_och_Participant,
new MyParticipantInstanceAttributeResponder());
         _rtiAmbassador.publishObjectClassAttributes(_och_Participant,
_oahs_Participant_forUpdate);
         //Note that associateRegionsForUpdates can be done only on a
per-instance basis
         //We publish federation-wide but will update and subscribe
through DDM
         //No federate *ever* subscribes to the nowhere "ChatRoom"

_rtiAmbassador.subscribeObjectClassAttributesWithRegions(_och_Particip
ant, _asrspl_Participant_waiting_room);
         //Update listener is already in place

         return true;
      } catch (Exception e) {
         e.printStackTrace();
         return false;
      } finally {
      } //try
   }
   /**
    * Used by various methods to acquire ownership of the
ChatRoomRegistry.
    * It is expected to be called by a statement like:
    * synchronized(AcquireChatRoomRegistry()) {}
    */
   private aChatRoomRegistry
   AcquireChatRoomRegistry()
   {
      //Can't synchronize on _ChatRoomRegistry because the waitFor
will only release its Semaphore
      //argument, and the AcquisitionNotification will need to
synchronize on _ChatRoomRegistry.
      //The Java wait method only frees up the monitor of the object
it is invoked on --there is no way to
      //"wait" for a *set* of monitors.
//    synchronized(_ChatRoomRegistry)
//    {
         if (_ChatRoomRegistry.owned) return _ChatRoomRegistry;
         synchronized(_sem_acquisition)
         {
            try {
               FederateAmbassadorAttributeOwnership previous =
(FederateAmbassadorAttributeOwnership)_fedAmbassador.setOwnershipListe
ner(_och_ChatRoomRegistry, new
MyChatRoomRegistryOwnershipListener(_sem_acquisition));
               _sem_acquisition.value = false;

_rtiAmbassador.attributeOwnershipAcquisition(_ChatRoomRegistry.handle,
_oahs_ChatRoomRegistry, null);
               waitFor(_sem_acquisition);

_fedAmbassador.setOwnershipListener(_och_ChatRoomRegistry, previous);
               return _ChatRoomRegistry;
            } catch (Exception ignored) {
            } //try
         } //synchronized(_sem_acquisition)
         //Failure to acquire is not an option
         return null;
//    } //synchronized(_ChatRoomRegistry)
   }
   /**
    * Used by various methods to remove a ChatRoom from the registry
and update the latter.
    * Remember that the ChatRoomRegistry only maps ChatRoom names to
slots; it does not link
    * to ChatRoom object instances at all.
    * @param slot a short specifying the ChatRoom entry to remove
    */
   private void
   RemoveChatRoomAndUpdateRegistry(short slot)
   {
      //Presumes _ChatRoomRegistry has been synchronized on
      try {
         boolean updateNeeded = false;
         if (slot <= _slot_general_ChatRoom) return; //waiting_room
and General are fixtures
         for (int i = 0; i < _ChatRoomRegistry.list.size(); i++)
         {
            if (slot ==
((ChatRoomRegistryEntry)_ChatRoomRegistry.list.get(i)).slot.getValue()
)
            {
               _ChatRoomRegistry.list.remove(i);
               updateNeeded = true;
               break;
            } //if
         } //for
         if (!updateNeeded) return;
         AttributeHandleValueMap _ahvm_ChatRoomRegistry =
_rtiAmbassador.getAttributeHandleValueMapFactory().create(_oahs_ChatRo
omRegistry_forUpdate.size());
         _ahvm_ChatRoomRegistry.put(_oah_ChatRoomRegistry_list,
_ChatRoomRegistry.list.toByteArray());

_rtiAmbassador.updateAttributeValues(_ChatRoomRegistry.handle,
_ahvm_ChatRoomRegistry, null);
      } catch (Exception ignored) {
      } finally {
      } //try
   }
   /**
    * Used by various methods to add a ChatRoom to the registry and
update the latter.
    * The ChatRoom is also added to _theChatRooms
    * @param name a String specifying the ChatRoom name to give to the
new entry (it'll be prefixed by the method)
    * @return the newly created aChatRoom object (null in case of
failure)
    */
   private aChatRoom
   AddChatRoomAndUpdateRegistry(String name)
   {
      //Must be called from the event-handling thread
      //Presumes _ChatRoomRegistry has been synchronized on
      try {
         //To allow user names and chat room names to be anything, the
latter will be prefixed
         //by "p" and "c", respectively, whilst our reserved names
will be prefixed by "_"
         String newChatRoomName = "c" + name;
         aChatRoom _ChatRoom = SeekChatRoomByName(newChatRoomName);
         if (_ChatRoom != null)
         {
            javax.swing.JOptionPane.showMessageDialog(null, "The chat
room name «" + name + "» already exists. Sorry!",
_federateHandle.toString(),
javax.swing.JOptionPane.INFORMATION_MESSAGE);
            return null;
         } //if
         //At this point we know the name is OK; now find a slot
number
         short candidate = _slot_FirstFreeChatRoomSlot;
         //Each SeekChatRoom method synchronizes on _theChatRooms
         for ( ; null != SeekChatRoomBySlot(candidate); candidate++);
         //We'll use candidate for the slot value
         _ChatRoomRegistry.list.add(_ChatRoomRegistry.list.size(), new
ChatRoomRegistryEntry(newChatRoomName, new
HLAinteger16BE(candidate)));
         AttributeHandleValueMap _ahvm_ChatRoomRegistry =
_rtiAmbassador.getAttributeHandleValueMapFactory().create(_oahs_ChatRo
omRegistry_forUpdate.size());
         _ahvm_ChatRoomRegistry.put(_oah_ChatRoomRegistry_list,
_ChatRoomRegistry.list.toByteArray());

_rtiAmbassador.updateAttributeValues(_ChatRoomRegistry.handle,
_ahvm_ChatRoomRegistry, null);
```

```
         _ChatRoom = new aChatRoom(newChatRoomName, candidate);
         _ChatRoom.subscribed = _ChatRoom.owned = true;
         synchronized(_theChatRooms)
         {
            _theChatRooms.put(_ChatRoom.handle =
_rtiAmbassador.registerObjectInstance(_och_ChatRoom), _ChatRoom);
         } //synchronized(_theChatRooms)
         return _ChatRoom;
      } catch (Exception ignored) {
      } finally {
      } //try
      return null;
   }

   /** Exit the Application */
   private void exitForm(java.awt.event.WindowEvent evt)
   {
      try {
         _me_shutting_down = true;
         //This runs in the event-handling thread ("AWT-EventQueue-0")
         if (_rtiAmbassador!=null)
         {
            lblStatus.setText("MyChat shutting down...");
            if (_me_logged_in) doLogout();
//          if ("Log Out".equals(btnLogon.getText())) doLogout();
            doUnsubscribe();
            if (!_alone) doForceDivest();
            doUnpublish();
            try {
               //Any remaining owned objects will be deleted (there
should be none when !_alone, really) (well, maybe some Region
objects...)

_rtiAmbassador.resignFederationExecution(ResignAction.DELETE_OBJECTS_T
HEN_DIVEST);
               //OwnershipAcquisitionPending, FederateOwnsAttributes,
FederateNotExecutionMember, RTIinternalError
               lblStatus.setText("MyChat shutting down - Resigning
from federation");
               _rtiAmbassador.destroyFederationExecution(fedex);
               //FederatesCurrentlyJoined,
FederationExecutionDoesNotExist, RTIinternalError
               lblStatus.setText("MyChat shutting down - Federation "
+ fedex + " destroyed");
            } catch (RTIexception ignored) {
            } //try
         } //if
      } finally {
         System.exit(0);
      } //try
   }
   private void
   doUnsubscribe()
   {
      try {

_rtiAmbassador.unsubscribeInteractionClassWithRegions(_ich_Communicati
on, _rhs_waiting_room_ChatRoom);


_rtiAmbassador.unsubscribeObjectClassAttributes(_och_ChatRoom,
_oahs_ChatRoom_forUpdate);

_rtiAmbassador.unsubscribeObjectClassAttributesWithRegions(_och_Partic
ipant, _asrspl_Participant_waiting_room);


_rtiAmbassador.unsubscribeObjectClassAttributes(_och_ChatRoomRegistry,
_oahs_ChatRoomRegistry_forUpdate);
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }

   private void
   doUnpublish()
   {
      try {
         _rtiAmbassador.unpublishInteractionClass(_ich_Communication);

         _rtiAmbassador.unpublishObjectClassAttributes(_och_ChatRoom,
_oahs_ChatRoom_forUpdate);
         //unassociateRegionsForUpdates can only be done on a per-
instance basis

_rtiAmbassador.unpublishObjectClassAttributes(_och_Participant,
_oahs_Participant_forUpdate);


_rtiAmbassador.unpublishObjectClassAttributes(_och_ChatRoomRegistry,
_oahs_ChatRoomRegistry_forUpdate);
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }
   private void
   divestChatRoomRegistry()
   {
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      //This usually runs in the event-handling thread ("AWT-
EventQueue-0") but can be called from other threads
      try {
         if (!_ChatRoomRegistry.owned) return;
         Semaphore _sem_divest = new Semaphore();
         synchronized(_sem_divest)
         {
            _sem_divest.value = false;
            java.lang.Object _oldListener =
_fedAmbassador.setOwnershipListener(_och_ChatRoomRegistry, new
MyChat.MyChatRoomRegistryOwnershipListener(_sem_divest));
            _ChatRoomRegistry.divesting = true;

_rtiAmbassador.negotiatedAttributeOwnershipDivestiture(_ChatRoomRegist
ry.handle, _oahs_ChatRoomRegistry, null);
            //Other federates will receive
requestAttributeOwnershipAssumption and
            //respond with attributeOwnershipAcquisitionIfAvailable.
            //We'll get requestDivestitureConfirmation, to which we'll
confirmDivestiture
            //Once that is done, we no longer own _ChatRoomRegistry
and can resign normally.
            waitFor(_sem_divest);
//          _fedAmbassador.setOwnershipListener(_och_ChatRoomRegistry,
null);
            _fedAmbassador.setOwnershipListener(_och_ChatRoomRegistry,
(FederateAmbassadorAttributeOwnership)_oldListener);
         } //synchronized(_sem_divest)
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }
   private void
   divestChatRooms()
   {
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      //This usually runs in the event-handling thread ("AWT-
EventQueue-0") but can run from other threads
      try {
         //ChatRoom objects
         aChatRoom _ChatRoom;
         Semaphore _sem_divest = new Semaphore();
         synchronized(_sem_divest)
         {
            java.lang.Object _oldListener =
_fedAmbassador.setOwnershipListener(_och_ChatRoom, new
MyChat.MyChatRoomOwnershipListener(_sem_divest, null));
            //Any federate callbacks requesting ownership assumption
will be turned down right away;
            //however, ownership acquisition notifications could
conceivably squeak through
            //(if another federate started shutting down just before
this one does) and would lock
            //up on the synchronized(_theChatRooms), so we take a
snapshot and release the monitor right away.
            aChatRoom[] _ChatRooms;
            synchronized(_theChatRooms)
            {
               _ChatRooms = (aChatRoom[])
_theChatRooms.values().toArray(new aChatRoom[0]);
            } //synchronized(_theChatRooms)
//          for (Iterator i = _theChatRooms.entrySet().iterator();
i.hasNext();)
            for (int i = 0; i < _ChatRooms.length; i++)
            {
//             _ChatRoom =
(aChatRoom)((java.util.Map.Entry)i.next()).getValue();
               _ChatRoom = _ChatRooms[i];
                                                                  + "
slot: " + _ChatRoom.slot.toString()
                                                                  + "
handle: " + _ChatRoom.handle.toString());
               if (_ChatRoom.owned)
               {
                  _sem_divest.increaseCount();
                  _ChatRoom.divesting = true;

_rtiAmbassador.negotiatedAttributeOwnershipDivestiture(_ChatRoom.handl
e, _oahs_ChatRoom, null);
                  //Other federates will receive
requestAttributeOwnershipAssumption and
                  //respond with
attributeOwnershipAcquisitionIfAvailable.
                  //We'll get requestDivestitureConfirmation, to which
we'll confirmDivestiture
                  //Once that is done, we no longer own any ChatRooms
and can resign normally.
               } //if
            } //for
            if (!_sem_divest.zero())
            {
               waitFor(_sem_divest);
            } //if
//          _fedAmbassador.setOwnershipListener(_och_ChatRoom, new
MyChat.MyChatRoomOwnershipListener(null, null));
            _fedAmbassador.setOwnershipListener(_och_ChatRoom,
(FederateAmbassadorAttributeOwnership)_oldListener);
         } //synchronized(_sem_divest)
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }

   private void
   divestParticipants()
   {
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      //This usually runs in the event-handling thread ("AWT-
EventQueue-0") but could be called from other threads
      try {
         //Participant objects
         aParticipant _Participant;
         Semaphore _sem_divest = new Semaphore();
         synchronized(_sem_divest)
         {
            java.lang.Object _oldListener =
_fedAmbassador.setOwnershipListener(_och_Participant, new
MyChat.MyParticipantOwnershipListener(_sem_divest, null));
            //Any federate callbacks requesting ownership assumption
will be turned down right away;
            //however, ownership acquisition notifications could
conceivably squeak through
            //(if another federate started shutting down just before
this one does) and would lock
            //up on the synchronized(_theParticipants), so we take a
snapshot and release the monitor right away.
            aParticipant[] _Participants;
            synchronized(_theParticipants)
            {
               _Participants = (aParticipant[])
_theParticipants.values().toArray(new aParticipant[0]);
            } //synchronized(_theParticipants)
```

```
//          for (Iterator i = _theParticipants.entrySet().iterator();
i.hasNext();)
            for (int i = 0; i < _Participants.length; i++)
            {
//             _Participant =
(aParticipant)((java.util.Map.Entry)i.next()).getValue();
               _Participant = _Participants[i];
                                                                  + "
slot: " + _Participant.chat_room_slot.toString()
                                                                  + "
handle: " + _Participant.user_handle.toString());
               if (_Participant.owned)
               {
                  _sem_divest.increaseCount();
                  _Participant.divesting = true;

_rtiAmbassador.negotiatedAttributeOwnershipDivestiture(_Participant.ha
ndle, _oahs_Participant, null);
                  //Other federates will receive
requestAttributeOwnershipAssumption and
                  //respond with
attributeOwnershipAcquisitionIfAvailable.
                  //We'll get requestDivestitureConfirmation, to which
we'll confirmDivestiture
                  //Once that is done, we no longer own any
Participants and can resign normally.
               } //if
            } //for
            if (!_sem_divest.zero())
            {
               waitFor(_sem_divest);
            } //if
//          _fedAmbassador.setOwnershipListener(_och_Participant, new
MyChat.MyParticipantOwnershipListener(null, null));
            _fedAmbassador.setOwnershipListener(_och_Participant,
(FederateAmbassadorAttributeOwnership)_oldListener);
         } //synchronized(_sem_divest)
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }
   private void
   doForceDivest()
   {
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      //This runs in the event-handling thread ("AWT-EventQueue-0")
      try {
         //ChatRoomRegistry object
         divestChatRoomRegistry();
         //ChatRoom objects
         divestChatRooms();
         //Participant objects
         divestParticipants();
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }

   /**
    * The btnLogon is used to Log On and to Log Out.
    */
   private void btnLogonActionPerformed(java.awt.event.ActionEvent
evt)
   {
      //This runs in the event-handling thread ("AWT-EventQueue-0")
      if (_me_logged_in) // ("Log Out".equals(btnLogon.getText()))
      {
         //Log out procedure
         doLogout();
      } else {
         //Log In procedure
         doLogin();
      } //if
   }
   private void
   doLogin()
   {
      try {
         //This runs in the event-handling thread ("AWT-EventQueue-0")
         _me_logging_in = true;
         if (!registerParticipant())
         {
            _me_logging_in = false;
            return;
         } //if
         _me_logged_in = true;

_rtiAmbassador.subscribeInteractionClassWithRegions(_ich_Communication
, _rhs_current_ChatRoom);

_rtiAmbassador.subscribeInteractionClassWithRegions(_ich_Communication
, _rhs_myParticipantRegion);
         _me_logging_in = false;
         txtUsername.setEnabled(false);
         btnLogon.setText("Log Out");
//       btnSendMessage.setEnabled(true);
         txtMessage.setEnabled(true);
         lblChatRoom.setEnabled(true);
         lstChatRooms.setEnabled(true);
         btnNewChatRoom.setEnabled(true);
         lblSendTo.setEnabled(true);
         lstSendTo.setEnabled(true);
         txtMessage.requestFocus();
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }
   private boolean
   registerParticipant()
   {
      java.util.Map.Entry _m;
      ObjectInstanceHandle _h;
      aParticipant _p;
      aParticipant _Participant;
      //This runs in the event-handling thread ("AWT-EventQueue-0")
because it is called from it

      //This method's purpose is to validate the user name;
      //if it succeeds, the Participant object with the
      //requested user name is now owned by this federate.
      //We know it won't be an empty String because the button is
disabled when the txtUsername is empty.
      _me.name.setValue("p" + txtUsername.getText());
//    _me.handle = null; //ObjectInstanceHandle of the Participant
object
//    _me.user_handle.setValue(0); //Same value, as an HLAint32 for
DDM purposes
      try {
         // Reserve name
         boolean reservation_succeeded;
         synchronized(_sem_reservation)
         {
            _sem_reservation.value = false;

_fedAmbassador.setNameReservationListener(_me.name.toString(), new
MyNameReservationListener(_sem_reservation));

_rtiAmbassador.reserveObjectInstanceName(_me.name.toString());
            // Wait for reservation succeeded/failed
            waitFor(_sem_reservation);

_fedAmbassador.setNameReservationListener(_me.name.toString(), null);
            reservation_succeeded = _sem_reservation.value;
         } //synchronized(_sem_reservation)
         //Prepare the <General> ChatRoom
         _rhs_current_ChatRoom =
_rtiAmbassador.getRegionHandleSetFactory().create();
         //Arrival (<General>) ChatRoom is slot 2
         _rh_current_ChatRoom = _rh_general_ChatRoom;
         _rhs_current_ChatRoom.add(_rh_current_ChatRoom);

_rtiAmbassador.commitRegionModifications(_rhs_current_ChatRoom);
//Won't complain if there are no mods to commit
         _asrspl_Participant_current =
_rtiAmbassador.getAttributeSetRegionSetPairListFactory().create(1);
         _asrspl_Participant_current.add(new
AttributeRegionAssociation(_oahs_Participant_forUpdate,
_rhs_current_ChatRoom));
         //Note that the prepared association has not been applied yet
         if (reservation_succeeded)
         {
            //For chat_room_slot filtering, we associate all
"forUpdate" attributes to _dh_ChatRoomSlots regions
            //We'd get InvalidRegionContext when subscribing if we
included the DeletePrivilege
            synchronized(_me)
            {
               _me.logged_in.setBoolean(_me.owned = _me.subscribed =
!(_me.inscope = _me.divesting = false));
               _me.chat_room_slot.setValue(_slot_nowhere_ChatRoom);
               //If there were any federates subscribed to the
creation region (nowhere),
               //there would be Discovery and Auto-Update would
trigger our InstanceAttributeResponder and all that;
               //Hence the atomic register-and-put; the
synchronized(_me) would delay a bit until the _me.user_handle is set
               //But since no-one subscribes to nowhere, there is no
rush
               synchronized(_theParticipants)
               {
                  _theParticipants.put(_me.handle =
_rtiAmbassador.registerObjectInstanceWithRegions(_och_Participant,
_asrspl_Participant_nowhere, _me.name.toString()), _me);
               } //synchronized(_theParticipants)
//
_me.user_handle.setValue(ObjectInstanceHandleToInt(_me.handle));
               _me.user_handle.setValue(_me.handle.hashCode());
            } //synchronized(_me)
         } else {
            //At this point, we know the desired Participant object
exists --we just don't know where it is.
            //If it is logged-out, it'll be in the waiting_room and we
will discover it there and can then acquire it.
            //It is logged-in by someone else, it'll be in some other
ChatRoom (2+) and we won't discover it
            //and cannot use it. There is no "fail-fast" in that
situation, however.
            //It is reasonably safe to assume that if we don't know of
the sought Participant, it must be logged in by someone else.

            //Is the object known?
            try {
               try {
                  _Participant =
SeekParticipant(_rtiAmbassador.getObjectInstanceHandle(_me.name.toStri
ng()));
               } catch (ObjectInstanceNotKnown ex) {
                  //The Participant was unknown; it cannot be in the
waiting_room
                  lblStatus.setText(_me.name.toString().substring(1) +
" is already logged-in.  Sorry!");
                  _me.name.setValue("");
                  return false;
               } //try
            } finally {
            } //try
            //At this point, the sought Participant is known

            //If freshly discovered, we could wait for its user_handle
to be updated by reflectAttributeValues (this is the
            //only field guaranteed to change) so that we can then
safely look up its logged_in or chat_room_slot values.
            //Instead, we'll request ownership right away; a logged-in
Participant will fail.

            //It could be already owned (if it was an unused
Participant we just happened to have the custody of)
            if (!_Participant.owned)
            {
               //For a Participant to be eligible for acquisition, it
must be in the
               //_waiting_room and therefore inscope
               boolean acquisition_succeeded = false;
               if (_Participant.inscope)
               {
                  //If the _Participant goes out of scope before we
get to the attributeOwnershipAcquisition call,
                  //we'll be stuck at the semaphore. This may happen
if there is a race for the same Participant.
                  //About the only way around this risk I can see may
be to have the acquiring federates first
                  //grab the ChatRoomRegistry (before testing
inscope), releasing it once the Participant
                  //acquisition is completed.
                  //This is a form of queueing, where the federates
are passing between themselves a token
                  //(the ChatRoomRegistry) which gives them the
"right" to attempt acquisition. The
                  //disadvantage is that it creates an artificial
bottleneck (and extra traffic).
                  synchronized(_sem_acquisition)
                  {
                     _sem_acquisition.value = false;

_fedAmbassador.setOwnershipListener(_och_Participant, new
MyParticipantOwnershipListener(_sem_acquisition,
_Participant.handle));
                     //Before acquiring, set up update regions so they
do not lapse during ownership transfer

_rtiAmbassador.associateRegionsForUpdates(_Participant.handle,
_asrspl_Participant_nowhere);

_rtiAmbassador.associateRegionsForUpdates(_Participant.handle,
_asrspl_Participant_waiting_room);

_rtiAmbassador.attributeOwnershipAcquisition(_Participant.handle,
_oahs_Participant, null);
                     waitFor(_sem_acquisition);

_fedAmbassador.setOwnershipListener(_och_Participant, new
MyParticipantOwnershipListener(null, null));
                     acquisition_succeeded = _sem_acquisition.value;
                  } //synchronized(_sem_acquisition)
               } //if
               if (!acquisition_succeeded)
               {
                  //Acquisition failed: someone else is logged in
under that Participant
                  lblStatus.setText(_me.name.toString().substring(1) +
" is already logged-in.  Sorry!");
                  _me.name.setValue("");
                  return false;
               } //if
               //Acquisition succeeded: that Participant was available
            } //if
            synchronized(_me)
            {
               _me = _Participant;
//             _me.divesting = false; //could be still true; will be
fixed later
               _me.logged_in.setBoolean(_me.owned = true);
//
_me.user_handle.setValue(ObjectInstanceHandleToInt(_me.handle));
               _me.user_handle.setValue(_me.handle.hashCode());
               //Removing _me from the waiting_room will trip
Attribute Scope Advisories
               _rtiAmbassador.unassociateRegionsForUpdates(_me.handle,
_asrspl_Participant_waiting_room);
               //At this point, _me.handle is only associated with
_asrspl_Participant_nowhere
               _me.chat_room_slot.setValue(_slot_nowhere_ChatRoom);
            } //synchronized(_me)
         } //if
         //Does the General ChatRoom exist?
         synchronized(_theChatRooms)
         {
            _general_ChatRoom =
SeekChatRoomBySlot(_slot_general_ChatRoom);
            if (null == _general_ChatRoom)
            {
               synchronized(AcquireChatRoomRegistry())
               {
                  _general_ChatRoom = new
aChatRoom(_name_general_ChatRoom, _slot_general_ChatRoom);
                  _general_ChatRoom.owned =
_general_ChatRoom.subscribed = true;
//                _general_ChatRoom.divesting = false;
                  _theChatRooms.put(_general_ChatRoom.handle =
_rtiAmbassador.registerObjectInstance(_och_ChatRoom),
_general_ChatRoom);
                  //No need to add the General ChatRoom to the
_ChatRoomRegistry, as it is already listed
               } //synchronized(AcquireChatRoomRegistry())
            } else {
            } //if
         } //synchronized(_theChatRooms)
         //It is just barely possible, given thread sequencing and RTI
transmission delays, that two (or more)
         //copies of the general chat room (or any other chat room
except for the waiting room) may end up
         //being created.  This does not matter for Participant
regions since the slots won't be affected
         //(the ChatRoomRegistry controls slot assignment, and its
ownership is passed from federate to federate).
         //We could try to cut down on such situations by checking
upon Discovery --if one discovers a ChatRoom
         //duplicate (same name and therefore slot), and one owns one
of the two, acquire the Registry (this
         //being a race condition, the owner of the duplicate could be
trying to do the same, so this acquisition
         //acts as a tie-breaker) then, if the condition still holds,
acquire aggressively the duplicate.
         //Once that is achieved, delete the duplicate. Removal
responders would need to check for duplicates
         //in their lists of ChatRooms, so if one is advised of the
removal of _general_ChatRoom or _myChatRoom
         //(the only two that matter), effect the substitution rather
than setting the member to null.
         //Substitution would also inhibit deletion of the entry in
lstChatRooms.
         //When shutting down a chat room, we should also delete
repeatedly until the name does not appear in
         //the list any more.

         //The converse is also just barely possible: one federate
could delete a ChatRoom just as another
         //is in the process of joining it. Again, this is a matter
for the Removal responder. If one is
         //advised of the Removal of a ChatRoom that matters, and
there is no duplicate extant, then one
         //must recreate the ChatRoom object.

         //Another possible solution to these kinds of problems would
be to make the federates time-constrained
         //and time-regulating. Time-stamping the deletions and
creations of chat rooms could be used to ensure
         //that all federate callbacks are processed before any action
is taken.

         //For expediency's sake, this level of coding has not been
implemented here.
```

```
         //This association will trigger Attribute Scope Advisories,
Discovery:
         _myChatRoom = _general_ChatRoom;
         _me.chat_room_slot.setValue(_slot_general_ChatRoom);
         _me_logged_in = !(_me_logging_in = false);
         //If you associate first and then subscribe, a previously
known object won't trip the scope advisories (?)

_rtiAmbassador.subscribeObjectClassAttributesWithRegions(_och_Particip
ant, _asrspl_Participant_current);
         //Add the _general ChatRoom association to the pre-existing
_nowhere ChatRoom association
         _rtiAmbassador.associateRegionsForUpdates(_me.handle,
_asrspl_Participant_current);

         //Subscription will refresh subscribed Participants;
         //since we use Auto-Provide, an explicit Update request is
not needed
         lblStatus.setText("Welcome, " +
_me.name.toString().substring(1));

         //Subscribe to the interaction
         //We'll be listening to interactions that come in on our
user-handle channel in addition to the chat-room-slot channel
         //It is the interaction sender's responsibility to pick the
channels to use
         _rh_myParticipantRegion =
_rtiAmbassador.createRegion(_dhs_UserHandleSlotsSet);
         //setRangeBounds must be invoked at least once for each
dimension specified.
         //Only then can commitRegionModifications be invoked to turn
the region template into a region specification.
         _rtiAmbassador.setRangeBounds(_rh_myParticipantRegion,
_dh_UserHandleSlots, new RangeBounds(_me.user_handle.getValue(),
_me.user_handle.getValue() + 1));
         _rhs_myParticipantRegion =
_rtiAmbassador.getRegionHandleSetFactory().create();
         _rhs_myParticipantRegion.add(_rh_myParticipantRegion);

_rtiAmbassador.commitRegionModifications(_rhs_myParticipantRegion);
         //subscribeInteractionClassWithRegions done by doLogin

         return true;
      } catch (RTIexception e) {
         e.printStackTrace();
         return false;
      } finally {
      } //try
   }
   private void
   doLogout()
   {
      try {
         //This runs in the event-handling thread ("AWT-EventQueue-0")
         //Log out procedure
         _me_logged_in = false;
         //Move from "current" ChatRoom to "waiting_room" ChatRoom
         //Unsubscribe from the current ChatRoom

_rtiAmbassador.unsubscribeInteractionClassWithRegions(_ich_Communicati
on, _rhs_current_ChatRoom);
         //Unsubscribe from the user handle channel

_rtiAmbassador.unsubscribeInteractionClassWithRegions(_ich_Communicati
on, _rhs_myParticipantRegion);

         //Look at the ChatRoom we're leaving to decide whether to
delete it or not
         int count = 0;
         synchronized(_theParticipants)
         {
            aParticipant _iParticipant;
            for (Iterator i = _theParticipants.values().iterator();
i.hasNext();)
            {
               _iParticipant = (aParticipant)i.next();
               //Out of scope Participants have unreliable attributes;
they cannot be in our ChatRoom in any case
               //The only exceptions are owned Participants: any owned
orphans can only be in the waiting_room
               //_me isn't counted
               if ((!_me.handle.equals(_iParticipant.handle)) &&
(_iParticipant.inscope) &&
(_me.chat_room_slot.equals(_iParticipant.chat_room_slot))) count++;
            } //for
         } //synchronized(_theParticipants)

         //This'll cause the Participants in our ChatRoom to go out of
scope

_rtiAmbassador.unsubscribeObjectClassAttributesWithRegions(_och_Partic
ipant, _asrspl_Participant_current);

         //What if someone logs into the ChatRoom after we've counted
its Participants but before we actually delete it?
```

```
         //Doesn't seem worth synchronizing on _myChatRoom
         if (count <= 0) //Should be just ==0 but you never know
(because of inscope, _me isn't counted)
         {
            //We were the only Participant left in the ChatRoom;
delete it as we leave (we must be the owner, obviously)
            synchronized(AcquireChatRoomRegistry())
            {
//             _theChatRooms.remove(_myChatRoom.handle); //Because
we're the owner, we won't get a RemoveObjectInstance notification
//             _rtiAmbassador.deleteObjectInstance(_myChatRoom.handle,
null);
               //Because we're the owner, we won't get a
RemoveObjectInstance notification
               //The remove returns the removed value, which is
_myChatRoom

_rtiAmbassador.deleteObjectInstance(((aChatRoom)_theChatRooms.remove(_
myChatRoom.handle)).handle, null);

RemoveChatRoomAndUpdateRegistry(_myChatRoom.slot.getValue());
               if
(!_myChatRoom.name.toString().equals(_name_general_ChatRoom))
               {

lstChatRooms.removeItem(_myChatRoom.name.toString().substring(1));
               } //if
            } //synchronized(AcquireChatRoomRegistry())
         } else if (_myChatRoom.owned)
         {
            //There are other Participants but we were the owner:
transfer ownership
            _myChatRoom.divesting = true;

_rtiAmbassador.negotiatedAttributeOwnershipDivestiture(_myChatRoom.han
dle, _oahs_ChatRoom, null);
         } //if
         _myChatRoom = null; //Should be OK; if being divested, it
still has a reference from _theChatRooms and therefore won't be
garbaged
```

```
         //The _me Participant is the only one that can be elsewhere
than the waiting_room and be owned;
         //by definition, an owned Participant stands in for the
federate in whichever ChatRoom it is
         //Move it from current to waiting_room
         _rtiAmbassador.unassociateRegionsForUpdates(_me.handle,
_asrspl_Participant_current);
         synchronized(_me)
         {
            _me.logged_in.setBoolean(false);
            _me.chat_room_slot.setValue(_slot_waiting_room_ChatRoom);
            _rtiAmbassador.associateRegionsForUpdates(_me.handle,
_asrspl_Participant_waiting_room);
            //AutoProvide will fetch our attribute update (since all
federates subscribe to the waiting_room ChatRoom at all times)
         } //synchronized(_me)
         _me = new aParticipant();

         //Delete the now unused regions
         _rhs_myParticipantRegion.remove(_rh_myParticipantRegion);
         _rtiAmbassador.deleteRegion(_rh_myParticipantRegion);
         _rh_myParticipantRegion = null;
         _rhs_myParticipantRegion = null;
         if (!_rh_current_ChatRoom.equals(_rh_general_ChatRoom))
         {
            _rtiAmbassador.deleteRegion(_rh_current_ChatRoom);
            _rh_current_ChatRoom = null;
         } //if

         //The lstSendTo will be emptied by the AttributeScopeListener
//       for (int i = 1; i < lstSendTo.getItemCount(); i++)
lstSendTo.removeItemAt(i);
//       btnSendMessage.setEnabled(false);
         txtMessage.setEnabled(false);
         lblChatRoom.setEnabled(false);
         lstChatRooms.setSelectedIndex(0); //So that we log back into
the _<General> chat room
         lstChatRooms.setEnabled(false);
         btnNewChatRoom.setEnabled(false);
         lblSendTo.setEnabled(false);
         lstSendTo.setEnabled(false);
         btnLogon.setText("Log In");
         txtUsername.setEnabled(true);
         txtUsername.requestFocus();
         btnLogon.getRootPane().setDefaultButton(btnLogon);
         lblStatus.setText("Welcome to MyChat - Please log in");
      } catch (Exception e) {
         e.printStackTrace();
      } finally {
      } //try
   }
   /**
    * The btnSendMessage is used to broadcast a chat message line.
    */
   private void
btnSendMessageActionPerformed(java.awt.event.ActionEvent evt)
   {
      //This runs in the event-handling thread ("AWT-EventQueue-0")
      try {
         //We know the message won't be empty because the button is
disabled when that is the case
         HLAunicodeString us_cmdline = new
HLAunicodeString(txtMessage.getText());
         //Note that there is no such thing as a ParameterHandleSet
         ParameterHandleValueMap _phvm_parameters =
_rtiAmbassador.getParameterHandleValueMapFactory().create(2);
         _phvm_parameters.put(_iph_Communication_message,
us_cmdline.toByteArray());
         _phvm_parameters.put(_iph_Communication_sender,
_me.name.toByteArray());
         //The lstSendTo can be used to send a private message (to a
single user) instead of all users in the current chat room
         if (lstSendTo.getSelectedIndex() == 0)
         {
            //This'll become WithRegions to handle ChatRooms...
//          _rtiAmbassador.sendInteraction(_ich_Communication,
_phvm_parameters, null);

_rtiAmbassador.sendInteractionWithRegions(_ich_Communication,
_phvm_parameters, _rhs_current_ChatRoom, null);
            txtArea.append(_me.name.toString().substring(1) + ": " +
us_cmdline + "\n");
            lblStatus.setText("Message sent");
         } else {
            //We'll use DDM to send the message to a single user
(within the same chat room)
            //The Participant object has three attributes, all three
of which are bound
            //to the ChatRoomSlots dimension; in addition, user_handle
is bound to UserHandleSlots.

            //To allow user names and chat room names to be anything,
the latter will be prefixed
            //by "p" and "c", respectively, whilst our reserved names
will be prefixed by "_"
            HLAunicodeString _us_TargetName = new HLAunicodeString("p"
+ lstSendTo.getSelectedItem().toString());
            //Although the lstSendTo cannot change on us (because
we're in the event-handling thread too),
            //the Participants could, so we must synchronize
            synchronized(_theParticipants)
            {
               //_us_TargetName is the name of a Participant object,
perforce known to us
//             ObjectInstanceHandle key =
_rtiAmbassador.getObjectInstanceHandle(_us_TargetName.toString());
               aParticipant _Participant =
SeekParticipantByName(_us_TargetName.toString());
               if (_Participant == null)
               {
                  javax.swing.JOptionPane.showMessageDialog(null,
_us_TargetName.toString().substring(1) + " unexpectedly logged out.
Message not sent.", _federateHandle.toString(),
javax.swing.JOptionPane.PLAIN_MESSAGE);
                  return;
               } //if
//             ObjectInstanceHandle key = _Participant.handle;
//             //long key_long = (long)
ObjectInstanceHandleToInt(key);
//             long key_long = (long) key.hashCode();
               //The _ich_Communication interaction has two
dimensions: UserHandleSlots and ChatRoomSlots
//             DimensionHandleSet dimensions =
_rtiAmbassador.getAvailableDimensionsForInteractionClass(_ich_Communic
ation);
               RegionHandle _rh_aParticipant =
_rtiAmbassador.createRegion(_dhs_UserHandleSlotsSet);
//             _rtiAmbassador.setRangeBounds(_rh_aParticipant,
_dh_UserHandleSlots, new RangeBounds(key_long, key_long + 1));
               _rtiAmbassador.setRangeBounds(_rh_aParticipant,
_dh_UserHandleSlots, new
RangeBounds(_Participant.user_handle.getValue(),
_Participant.user_handle.getValue() + 1));
               RegionHandleSet _rhs_aParticipant =
_rtiAmbassador.getRegionHandleSetFactory().create();
               _rhs_aParticipant.add(_rh_aParticipant);

_rtiAmbassador.commitRegionModifications(_rhs_aParticipant);

_rtiAmbassador.sendInteractionWithRegions(_ich_Communication,
_phvm_parameters, _rhs_aParticipant, null);
               //Now throw the region away
               _rhs_aParticipant.remove(_rh_aParticipant);
               _rtiAmbassador.deleteRegion(_rh_aParticipant);
            } //synchronized(_theParticipants)
            txtArea.append(_me.name.toString().substring(1) + " (to "
+ lstSendTo.getSelectedItem().toString() + "): " + us_cmdline + "\n");
            lblStatus.setText("Private message sent");
         } //if
         txtMessage.setText("");
      } catch (RTIexception e) {
         lblStatus.setText(e.getLocalizedMessage());
      } finally {
      } //try
   }
   /**
    * This utility method finds the Participant object in the hashmap
by its ObjectInstanceHandle.
    * @param theObject an ObjectInstanceHandle specifying the
Participant sought
    * @return the sought Participant object, or null if not present
    */
   private aParticipant
   SeekParticipant(ObjectInstanceHandle theObject)
   {
      synchronized(_theParticipants)
      {
         return (aParticipant)_theParticipants.get(theObject);
      } //synchronized(_theParticipants)
   }

   /**
    * This utility method finds the ChatRoom object in the hashmap by
its ObjectInstanceHandle.
    * @param theObject an ObjectInstanceHandle specifying the ChatRoom
sought
    * @return the sought ChatRoom object, or null if not present
    */
   private aChatRoom
   SeekChatRoom(ObjectInstanceHandle theObject)
   {
      synchronized(_theChatRooms)
      {
         return (aChatRoom)_theChatRooms.get(theObject);
      } //synchronized(_theChatRooms)
   }

   /**
    * This utility method finds the ChatRoom object in the hashmap by
its name.
    * @param name a String specifying the ChatRoom.name sought
    * @return the sought ChatRoom object, or null if not present
    */
   private aChatRoom
   SeekChatRoomByName(String name)
   {
      aChatRoom _ChatRoom;
      synchronized(_theChatRooms)
      {
         for (Iterator i = _theChatRooms.entrySet().iterator();
i.hasNext();)
         {
            _ChatRoom =
(aChatRoom)((java.util.Map.Entry)i.next()).getValue();
            if (_ChatRoom.name.toString().equals(name)) return
_ChatRoom;
         } //for
         return null;
      } //synchronized(_theChatRooms)
   }
   /**
    * This utility method finds the ChatRoom object in the hashmap by
its slot.
    * @param slot a short specifying the ChatRoom.slot sought
    * @return the sought ChatRoom object, or null if not present
    */
   private aChatRoom
   SeekChatRoomBySlot(short slot)
   {
      aChatRoom _ChatRoom;
      synchronized(_theChatRooms)
      {
         for (Iterator i = _theChatRooms.entrySet().iterator();
i.hasNext();)
         {
            _ChatRoom =
(aChatRoom)((java.util.Map.Entry)i.next()).getValue();
            if (_ChatRoom.slot.getValue() == slot) return _ChatRoom;
         } //for
         return null;
      } //synchronized(_theChatRooms)
   }

   /**
    * This utility method finds the Participant object in the hashmap
by its name.
    * @param name a String specifying the Participant.name sought
    * @return the sought Participant object, or null if not present
    */
   private aParticipant
   SeekParticipantByName(String name)
   {
      aParticipant _Participant;
      synchronized(_theParticipants)
      {
         for (Iterator i = _theParticipants.entrySet().iterator();
i.hasNext();)
         {
            _Participant =
(aParticipant)((java.util.Map.Entry)i.next()).getValue();
            if (_Participant.name.toString().equals(name)) return
_Participant;
         } //for
         return null;
      } //synchronized(_theParticipants)
   }
   /**
    * This utility method finds the Participant object in the hashmap
by its user_handle.
    * @param user_handle an int specifying the Participant.user_handle
sought
    * @return the sought Participant object, or null if not present
    */
   private aParticipant
   SeekParticipantByUserHandle(int user_handle)
   {
      aParticipant _Participant;
      synchronized(_theParticipants)
      {
         for (Iterator i = _theParticipants.entrySet().iterator();
i.hasNext();)
         {
            _Participant =
(aParticipant)((java.util.Map.Entry)i.next()).getValue();
            if (_Participant.user_handle.getValue() == user_handle)
return _Participant;
         } //for
         return null;
      } //synchronized(_theParticipants)
   }

   /**
    * This utility method provides the missing toByteArray method of
ObjectInstanceHandle.
    * @param o the ObjectInstanceHandle to encode
    * @return the byte[] representation of the ObjectInstanceHandle
    * @throws CouldNotDecode if something goes wrong
    */
   private byte[]
   ObjectInstanceHandleToByteArray(ObjectInstanceHandle o)
      throws CouldNotDecode
   {
      byte[] b = new byte[o.encodedLength()];
      o.encode(b, 0);
      return b;
   }
   /**
    * This utility method converts an ObjectInstanceHandle into an
integer (HLAinteger32BE).
    * This could break with later implementations of the RTI, should
it switch to 64-bit handles.
    * @param o the ObjectInstanceHandle to convert
    * @return the int representation of the ObjectInstanceHandle
    * @throws CouldNotDecode if something goes wrong
    */
   /**
   private int
   ObjectInstanceHandleToInt(ObjectInstanceHandle o)
      throws CouldNotDecode
   {
      //ObjectInstanceHandle has an encodedLength of 4
      final byte[] bytes = new byte[o.encodedLength()];
      o.encode(bytes, 0);
      return new HLAinteger32BE(bytes).getValue();
   }
    */
   private void
   waitFor(Object theSemaphore)
   {
      //This runs in the event-handling thread ("AWT-EventQueue-0")
because it is called from it
      try {
         synchronized(theSemaphore)
         {
            theSemaphore.wait();
         } //synchronized(theSemaphore)
      } catch (InterruptedException ignored) {
      } //try
   }

   /**
    * A simple class whose only purpose is to act as a semaphore
    * between Threads and carry a boolean payload (initially false).
    */
   public class
   Semaphore
//    extends Object
   {
      public boolean
      value = false;

      private int
      count;
      /**
       * Default constructor
       */
      public
      Semaphore()
      {
         this(0);
      }
      /**
       * Constructs a Semaphore of the specified initial count.
       * @param count an int specifying the Semaphore's initial count
       */
      public
      Semaphore(int theCount)
      {
         count = theCount;
      }

      /**
       * Whether the count has reached zero or not.
       * @return a boolean indicating whether the count has reached
zero or not
       */
      public boolean
      zero()
      {
         return (count == 0);
      }

      /**
       * Decreases the Semaphore's count by one.
       * The count cannot decrease below zero.
       */
      public void
      decreaseCount()
      {
         decreaseCount(1);
      }

      /**
       * Decreases the Semaphore's count by the specified amount.
       * The count cannot decrease below zero.
       * @param amount an int to decrease the count by
       */
      public void
      decreaseCount(int amount)
      {
         if (count > amount)
         {
            count -= amount;
         } else {
            count = 0;
         } //if
      }

      /**
       * Increases the Semaphore's count by one.
       */
      public void
      increaseCount()
      {
         increaseCount(1);
      }
      /**
       * Increases the Semaphore's count by the specified amount.
       * @param amount an int to increase the count by
       */
      public void
      increaseCount(int amount)
      {
         count += amount;
      }
   }

   ////////////////////////////////////////////
   // FederateAmbassador implementation bits //
   ////////////////////////////////////////////

   //These are all called from the Federate Service Thread ("Federate
service thread")

   //Name Reservation

   /**
    * Used with ChatRoomRegistry and Participant.
    * Note that we do not admit a null Semaphore.
    */
   public class
   MyNameReservationListener
      extends FedAmbNameReservationListener
   {
      private Semaphore whichSemaphore;

      //Constructor
      public
      MyNameReservationListener(Semaphore aSemaphore)
      {
         whichSemaphore = aSemaphore;
      }

      protected void
      doReservation(
         String  objectName,
         boolean succeeded)
      throws UnknownName,
             FederateInternalError
      {
         synchronized(whichSemaphore)
         {
            whichSemaphore.value = succeeded;
            whichSemaphore.notify();
         } //synchronized(whichSemaphore)
      } //method doReservation
   } //class MyNameReservationListener
   //Interactions

   public class
   MyCommunicationInteractionListener
      extends FedAmbInteractionListener
   {
      protected void
      doInteraction(
         InteractionClassHandle  interactionClass,
         ParameterHandleValueMap theParameters,
         byte[]                  userSuppliedTag,
         OrderType               sentOrdering,
         TransportationType      theTransport,
         LogicalTime             theTime,
         OrderType               receivedOrdering,
         MessageRetractionHandle messageRetractionHandle,
         RegionHandleSet         sentRegions)
      throws InteractionClassNotRecognized,
             InteractionParameterNotRecognized,
             InteractionClassNotSubscribed,
             InvalidLogicalTime,
             FederateInternalError
      {
         try {
            final HLAunicodeString _message = new HLAunicodeString();
            final HLAunicodeString _sender = new HLAunicodeString();
            for (Iterator i = theParameters.keySet().iterator();
i.hasNext(); )
            {
               ParameterHandle _parameterHandle =
(ParameterHandle)i.next();
               if
(_parameterHandle.equals(_iph_Communication_message))
               {

_message.decode((byte[])theParameters.get(_parameterHandle));
//                _message = new
String((byte[])_theParameters.get(_parameterHandle));
               } else if
(_parameterHandle.equals(_iph_Communication_sender)) {

_sender.decode((byte[])theParameters.get(_parameterHandle));
//                _sender = new
String((byte[])_theParameters.get(_parameterHandle));
               } //if
            } //for
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               txtArea.append(_sender.toString().substring(1) + ": " +
_message + "\n");
            } } ); //Runnable
         } catch (CouldNotDecode e) {
            e.printStackTrace();
         } finally {
         } //try
      } //method doInteraction
   } //class MyCommunicationInteractionListener
   //Discovery and Removal

   public class
   MyChatRoomRegistryDiscoveryListener
      extends FedAmbDiscoveryListener
   {
      private Semaphore whichSemaphore;

      //Constructor
      public
      MyChatRoomRegistryDiscoveryListener(Semaphore theSemaphore)
      {
         whichSemaphore = theSemaphore;
      }

      public void
      discoverObjectInstance(
         ObjectInstanceHandle theObject,
         ObjectClassHandle    theObjectClass,
         String               objectName)
      throws CouldNotDiscover,
             ObjectClassNotRecognized,
             FederateInternalError
      {
         try {
            if (!theObjectClass.equals(_och_ChatRoomRegistry)) throw
new ObjectClassNotRecognized("Unexpected object class");
            if (_ChatRoomRegistry.handle != null) throw new
CouldNotDiscover("ChatRoomRegistry already discovered");
            if (!_ChatRoomRegistry.subscribed) throw new
FederateInternalError("ChatRoomRegistry not subscribed");
            //Assuming AutoProvide, this'll be immediately followed by
an Update, so we cannot thread off
            _ChatRoomRegistry.handle = theObject;
            if (whichSemaphore == null) return;
            synchronized(whichSemaphore)
            {
               whichSemaphore.value = true;
               whichSemaphore.notify();
            } //synchronized(whichSemaphore)
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method discoverObjectInstance
   } //class MyChatRoomRegistryDiscoveryListener
   public class
   MyChatRoomDiscoveryListener
      extends FedAmbDiscoveryListener
   {
      private Semaphore whichSemaphore;

      //Constructor
      public
      MyChatRoomDiscoveryListener(Semaphore theSemaphore)
      {
         whichSemaphore = theSemaphore;
      }

      public void
      discoverObjectInstance(
         ObjectInstanceHandle theObject,
         ObjectClassHandle    theObjectClass,
         String               objectName)
      throws CouldNotDiscover,
             ObjectClassNotRecognized,
             FederateInternalError
      {
         try {
            if (!theObjectClass.equals(_och_ChatRoom)) throw new
ObjectClassNotRecognized("Unexpected object class");
            //Assuming AutoProvide, this'll be immediately followed by
an Update, so we cannot thread off
            synchronized(_theChatRooms)
            {
               aChatRoom _ChatRoom;
               if (objectName.equals(_name_waiting_room_ChatRoom))
               {
                  _ChatRoom = _waiting_room_ChatRoom;
               } else {
                  _ChatRoom = new aChatRoom("unknown", (short)-1);
               } //if
               _ChatRoom.handle = theObject;
               _ChatRoom.subscribed = true;
//             _ChatRoom.name and slot will come from Update; we must
wait until then before updating the GUI
               _theChatRooms.put(theObject, _ChatRoom);
               if (whichSemaphore == null) return;
            } //synchronized(_theChatRooms)
            synchronized(whichSemaphore)
            {
               whichSemaphore.value = true;
               whichSemaphore.notify();
            } //synchronized(whichSemaphore)
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method discoverObjectInstance
   } //class MyChatRoomDiscoveryListener
   public class
   MyChatRoomRemovalResponder
      extends FedAmbRemovalResponder
   {
      protected void
      doRemove(
         ObjectInstanceHandle    theObject,
         byte[]                  userSuppliedTag,
         OrderType               sentOrdering,
         LogicalTime             theTime,
         OrderType               receivedOrdering,
         MessageRetractionHandle retractionHandle)
      throws ObjectInstanceNotKnown,
             InvalidLogicalTime,
             FederateInternalError
      {
         try {
            final aChatRoom _ChatRoom =
(aChatRoom)_theChatRooms.remove(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unexpected object instance");
            if
(_ChatRoom.name.toString().equals(_name_general_ChatRoom)) return;
            SwingUtilities.invokeLater(new Runnable() { public void
run() {
               //Strip leading character
               String theChatRoomName =
_ChatRoom.name.toString().substring(1);
               lstChatRooms.removeItem(theChatRoomName);
            } } ); //Runnable
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method doRemove
   } //class MyChatRoomRemovalResponder

   public class
   MyParticipantDiscoveryListener
      extends FedAmbDiscoveryListener
   {
      private Semaphore
      whichSemaphore;
      private String
      whichName;

      //Constructor
      public
      MyParticipantDiscoveryListener(Semaphore aSemaphore, String
anObjectName)
      {
         whichSemaphore = aSemaphore;
         whichName      = anObjectName;
      }
      public void
      discoverObjectInstance(
         ObjectInstanceHandle theObject,
         ObjectClassHandle    theObjectClass,
         String               objectName)
      throws CouldNotDiscover,
             ObjectClassNotRecognized,
             FederateInternalError
      {
         try {
            if (!theObjectClass.equals(_och_Participant)) throw new
ObjectClassNotRecognized("Unexpected object class");

            //Because the discovery is immediately followed by the
firing of an InScope advisory, we cannot thread off
            //Maintain list of Participants (within the current
ChatRoom)
            try {
               synchronized(_theParticipants)
               {
                  aParticipant _Participant = new aParticipant();
                  _Participant.subscribed = true;
//                _Participant.inscope = false; //Default; the InScope
advisory will follow discovery in any case
                  _Participant.handle = theObject;
//
_Participant.name.setValue(_rtiAmbassador.getObjectInstanceName(theObj
ect));
                  _Participant.name.setValue(objectName);
                  _theParticipants.put(theObject, _Participant);
                  if (_me_shutting_down) return;
                  //We use the Auto-Provide switch, so an explicit
Update request is not needed
                  //We could add the discovered Participant's name to
lstSendTo right away,
                  //but we need to know in which ChatRoom slot it
resides, so we must wait for the InScope advisory
                  //(because we subscribe to two regions at any given
time, we can discover instances in either one)
                  //Unfortunately, even with ConveyRegionDesignators
set to true, this does not happen with the Discovery call
                  if (whichSemaphore == null) return;
                  //toString required because whichName is String but
_Participant.name is HLAunicodeString
                  if (!whichName.equals(_Participant.name.toString()))
return;
               } //synchronized(_theParticipants)
            } finally {
            } //try
            synchronized(whichSemaphore)
            {
               whichSemaphore.value = true;
               whichSemaphore.notify();
            } //synchronized(whichSemaphore)
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method discoverObjectInstance
   } //class MyParticipantDiscoveryListener

   //Ownership

   public class
   MyChatRoomRegistryOwnershipListener
      extends FedAmbOwnershipListener
   {
      private Semaphore whichSemaphore;

      //Constructor
      public
      MyChatRoomRegistryOwnershipListener(Semaphore aSemaphore)
      {
         whichSemaphore   = aSemaphore;
      }
      public void
      requestAttributeOwnershipAssumption(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   offeredAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeNotPublished,
             FederateInternalError
      {
         try {
            //Decline if we're in the process of shutting down (and
thus divesting)
            if (_me_shutting_down) return;
            if (!theObject.equals(_ChatRoomRegistry.handle)) throw new
ObjectInstanceNotKnown("Unexpected ChatRoomRegistry handle");
            if
(!offeredAttributes.containsAll(_oahs_ChatRoomRegistry)) throw new
AttributeNotRecognized("Unexpected attribute set offered");
            if (_ChatRoomRegistry.owned) throw new
AttributeAlreadyOwned("ChatRoomRegistry already owned");
            //Acquiesce if able
            //This condition is similar to !_me_logged_in but better
            if (!_ChatRoomRegistry.subscribed) return; //If not
subscribed, probably not up to date --decline

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  //Note that the divesting federate will have offered
ownership to all federates, and that even if they all acquiesce,
                  //only one will receive an
ownershipAcquisitionNotification; if we use
attributeOwnershipAcquisition, there won't be any
                  //negative feedback if we fail to get ownership --
and we'll have an outstanding acquisition request.
                  //This is why it is preferable to use
attributeOwnershipAcquisitionIfAvailable

_rtiAmbassador.attributeOwnershipAcquisitionIfAvailable(_ChatRoomRegis
try.handle, _oahs_ChatRoomRegistry);
               } catch(Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestAttributeOwnershipAssumption
      public void
      requestDivestitureConfirmation(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   offeredAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             AttributeDivestitureWasNotRequested,
             FederateInternalError
      {
         try {
            if (!theObject.equals(_ChatRoomRegistry.handle)) throw new
ObjectInstanceNotKnown("Unexpected ChatRoomRegistry handle");
            if
(!offeredAttributes.containsAll(_oahs_ChatRoomRegistry)) throw new
AttributeNotRecognized("Unexpected attribute set being divested");
            if (!_ChatRoomRegistry.owned) throw new
AttributeNotOwned("ChatRoomRegistry not owned");

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  synchronized(_ChatRoomRegistry)
                  {

_rtiAmbassador.confirmDivestiture(_ChatRoomRegistry.handle,
_oahs_ChatRoomRegistry, null);
                     _ChatRoomRegistry.owned =
_ChatRoomRegistry.divesting = false;
                  } //synchronized(_ChatRoomRegistry)
                  if (whichSemaphore == null) return;
                  synchronized(whichSemaphore)
                  {
                     whichSemaphore.value = true; //that would be
_sem_divestiture
                     whichSemaphore.notify();
                  } //synchronized(whichSemaphore)
               } catch(Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestDivestitureConfirmation
      public void
      attributeOwnershipAcquisitionNotification(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   securedAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAcquisitionWasNotRequested,
             AttributeAlreadyOwned,
             AttributeNotPublished,
             FederateInternalError
      {
         try {
            if (!theObject.equals(_ChatRoomRegistry.handle)) throw new
ObjectInstanceNotKnown("Unexpected ChatRoomRegistry handle");
            if
(!securedAttributes.containsAll(_oahs_ChatRoomRegistry)) throw new
AttributeNotRecognized("Unexpected attribute set secured");
            if (_ChatRoomRegistry.owned) throw new
AttributeAlreadyOwned("ChatRoomRegistry already owned");
            if (!_ChatRoomRegistry.subscribed) throw new
AttributeAcquisitionWasNotRequested("ChatRoomRegistry not
subscribed");
            //This completes the ownership transfer process

            synchronized(_ChatRoomRegistry)
            {
               _ChatRoomRegistry.owned = true ||
(_ChatRoomRegistry.divesting = _me_shutting_down);
            } //synchronized(_ChatRoomRegistry)
            if (whichSemaphore != null)
            {
               synchronized(whichSemaphore)
               {
                  whichSemaphore.value = true; //that would be
_sem_acquisition
                  whichSemaphore.notify();
               } //synchronized(whichSemaphore)
            } //if
            //Just in case we somehow managed to acquire whilst
switching to shutting down mode
            if (_me_shutting_down)
            {
               new Thread() { public void run() {
                  try {
                     divestChatRoomRegistry();
                  } catch (Exception ignored) {
                  } finally {
                  } //try
               } }.start(); //Thread
            } //if
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method attributeOwnershipAcquisitionNotification
      public void
      attributeOwnershipUnavailable(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotRequested,
             FederateInternalError
      {
         try {
            if (!theObject.equals(_ChatRoomRegistry.handle)) throw new
ObjectInstanceNotKnown("Unexpected ChatRoomRegistry handle");
            if (!theAttributes.containsAll(_oahs_ChatRoomRegistry))
throw new AttributeNotRecognized("Unexpected attribute set turned
down");
            if (_ChatRoomRegistry.owned) throw new
AttributeAlreadyOwned("ChatRoomRegistry already owned");
            if (!_ChatRoomRegistry.subscribed) throw new
AttributeAcquisitionWasNotRequested("ChatRoomRegistry not
subscribed");

            if (whichSemaphore == null) return;
            synchronized(whichSemaphore)
            {
               whichSemaphore.value = false; //that would be
_sem_acquisition
               whichSemaphore.notify();
            } //synchronized(whichSemaphore)
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method attributeOwnershipUnavailable

      public void
      requestAttributeOwnershipRelease(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   candidateAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             FederateInternalError
      {
         try {
            if (!theObject.equals(_ChatRoomRegistry.handle)) throw new
ObjectInstanceNotKnown("Unexpected ChatRoomRegistry handle");
            if
(!candidateAttributes.containsAll(_oahs_ChatRoomRegistry)) throw new
AttributeNotRecognized("Unexpected attribute set requested");
            if (!_ChatRoomRegistry.owned) throw new
AttributeNotOwned("ChatRoomRegistry not owned");
//          if (!_ChatRoomRegistry.subscribed) throw new
FederateInternalError("ChatRoomRegistry not subscribed");
            //Acquiesce
            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  //If we're currently busy with the ChatRoomRegistry,
                  //we'll be synchronized on it and this thread will
                  //have to wait
                  synchronized(_ChatRoomRegistry)
                  {
                     if
(!_oahs_ChatRoomRegistry.containsAll(_rtiAmbassador.attributeOwnership
DivestitureIfWanted(_ChatRoomRegistry.handle,
_oahs_ChatRoomRegistry))) return;
                     _ChatRoomRegistry.owned =
_ChatRoomRegistry.divesting = false;
                  } //synchronized(_ChatRoomRegistry)
                  if (whichSemaphore == null) return;
                  synchronized(whichSemaphore)
                  {
                     whichSemaphore.value = true; //that would be
_sem_divestiture
                     whichSemaphore.notify();
                  } //synchronized(whichSemaphore)
               } catch(Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestAttributeOwnershipRelease
      public void
      confirmAttributeOwnershipAcquisitionCancellation(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotCanceled,
             FederateInternalError
      {
         if (_ChatRoomRegistry.handle != theObject) throw new
ObjectInstanceNotKnown("Unknown ChatRoomRegistry offered");
         if (!theAttributes.containsAll(_oahs_ChatRoomRegistry)) throw
new AttributeNotRecognized("Unexpected attribute set cancelled");
         if (_ChatRoomRegistry.owned) throw new
AttributeAlreadyOwned("ChatRoomRegistry already owned");
         throw new AttributeAcquisitionWasNotCanceled("I don't think
so...");
      } //method confirmAttributeOwnershipAcquisitionCancellation
/**
      public void
      doInformOwnership(
         final ObjectInstanceHandle theObject,
         final AttributeHandle      theAttribute,
         final boolean              isUnowned,
         final boolean              isOwnedByRTI,
         final FederateHandle       theOwner)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             FederateInternalError
      {
      } //method doInformOwnership
 */
   } //class MyChatRoomRegistryOwnershipListener

   public class
   MyChatRoomOwnershipListener
      extends FedAmbOwnershipListener
   {
      private Semaphore            whichSemaphore;
      private ObjectInstanceHandle whichObject;
      //The Semaphore and ObjectInstanceHandle serve two purposes:
      // - In Acquisition mode, Semaphore.value will be set once an
acquisitionNotification or
//         Unavailable callback is received for the
ObjectInstanceHandle, and then the Semaphore is notified.
      // - In Divestiture mode, each requestDivestitureConfirmation
and requestAttributeOwnershipRelease
//         results in a Semaphore.decreaseCount; once Semaphore.zero()
is true, it is notified.
```

```
      //Constructor
      public
      MyChatRoomOwnershipListener(Semaphore aSemaphore,
ObjectInstanceHandle anObject)
      {
         whichSemaphore = aSemaphore;
         whichObject    = anObject;
      }
      public void
      requestAttributeOwnershipAssumption(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   offeredAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeNotPublished,
             FederateInternalError
      {
         try {
            //Decline if we're in the process of shutting down (and
thus divesting)
            if (_me_shutting_down) return;
            final aChatRoom _ChatRoom = SeekChatRoom(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unknown ChatRoom offered");
            if (!offeredAttributes.containsAll(_oahs_ChatRoom)) throw
new AttributeNotRecognized("Unexpected attribute set offered");
            if (_ChatRoom.owned) throw new
AttributeAlreadyOwned("ChatRoom already owned");
            //Also decline if:
            //We're not subscribed, thus the values are probably not
up to date; or
            //We're logged out and the ChatRoom slot is other than the
waiting_room
            if ((!_ChatRoom.subscribed) || ((!_me_logged_in) &&
(_ChatRoom.slot.getValue() != _slot_waiting_room_ChatRoom))) return;
            //Either we're logged in, and/or the chat room is the
waiting room;
            //If not the waiting room, accept only if its our current
chat room
            if ((_ChatRoom.slot.getValue() !=
_slot_waiting_room_ChatRoom) &&
(!_ChatRoom.slot.equals(_myChatRoom.slot))) return;

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  //Accept only if subscribed (and presumably up to
date)

_rtiAmbassador.attributeOwnershipAcquisitionIfAvailable(_ChatRoom.hand
le, _oahs_ChatRoom); //or theObject
               } catch(Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestAttributeOwnershipAssumption
      public void
      requestDivestitureConfirmation(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   offeredAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             AttributeDivestitureWasNotRequested,
             FederateInternalError
      {
         try {
            final aChatRoom _ChatRoom = SeekChatRoom(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unknown ChatRoom offered");
            if (!offeredAttributes.containsAll(_oahs_ChatRoom)) throw
new AttributeNotRecognized("Unexpected attribute set requested");
            if (!_ChatRoom.owned) throw new
AttributeNotOwned("ChatRoom not owned");

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  //Confirm
                  synchronized(_ChatRoom)
                  {

_rtiAmbassador.confirmDivestiture(_ChatRoom.handle, _oahs_ChatRoom,
null);
                     _ChatRoom.owned = _ChatRoom.divesting = false;
                  } //synchronized(_ChatRoom)
                  if (whichSemaphore == null) return;
                  synchronized(whichSemaphore)
                  {
                     whichSemaphore.decreaseCount();
                     if (whichSemaphore.zero()) {
whichSemaphore.notify(); }
                  } //synchronized(whichSemaphore)
               } catch(Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestDivestitureConfirmation
      public void
      attributeOwnershipAcquisitionNotification(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   securedAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAcquisitionWasNotRequested,
             AttributeAlreadyOwned,
             AttributeNotPublished,
             FederateInternalError
      {
         try {
            final aChatRoom _ChatRoom = SeekChatRoom(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unknown ChatRoom offered");
            if (!securedAttributes.containsAll(_oahs_ChatRoom)) throw
new AttributeNotRecognized("Unexpected attribute set acquired");
            if (_ChatRoom.owned) throw new
AttributeAlreadyOwned("ChatRoom already owned");

            synchronized(_ChatRoom)
            {
               _ChatRoom.owned = !(_ChatRoom.divesting = false);
            } //synchronized(_ChatRoom)
            if (whichSemaphore != null)
            {
               synchronized(whichSemaphore)
               {
                  whichSemaphore.value =
(_ChatRoom.handle.equals(whichObject));
                  if (whichSemaphore.value) whichSemaphore.notify();
               } //synchronized(whichSemaphore)
            } //if
            //Just in case we somehow managed to acquire whilst
switching to shutting down mode
            if (_me_shutting_down)
            {
               new Thread() { public void run() {
                  try {
                     divestChatRooms();
                  } catch (Exception ignored) {
                  } finally {
                  } //try
               } }.start(); //Thread
            } //if
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method attributeOwnershipAcquisitionNotification
      public void
      attributeOwnershipUnavailable(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotRequested,
             FederateInternalError
      {
         try {
            final aChatRoom _ChatRoom = SeekChatRoom(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unknown ChatRoom offered");
            if (!theAttributes.containsAll(_oahs_ChatRoom)) throw new
AttributeNotRecognized("Unexpected attribute set denied");
            if (_ChatRoom.owned) throw new
AttributeAlreadyOwned("ChatRoom already owned");
            if (whichSemaphore == null) return;
            synchronized(whichSemaphore)
            {
               whichSemaphore.value = false;
               if (_ChatRoom.handle.equals(whichObject))
whichSemaphore.notify();
            } //synchronized(whichSemaphore)
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method attributeOwnershipUnavailable
      public void
      requestAttributeOwnershipRelease(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   candidateAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             FederateInternalError
      {
         try {
            final aChatRoom _ChatRoom = SeekChatRoom(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unknown ChatRoom offered");
            if (!candidateAttributes.containsAll(_oahs_ChatRoom))
throw new AttributeNotRecognized("Unexpected attribute set
requested");
            if (!_ChatRoom.owned) throw new
AttributeNotOwned("ChatRoom not owned");
            //Acquiesce

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  if
(!_oahs_ChatRoom.containsAll(_rtiAmbassador.attributeOwnershipDivestit
ureIfWanted(_ChatRoom.handle, _oahs_ChatRoom))) return;
                  //Success!
                  synchronized(_ChatRoom)
                  {
                     _ChatRoom.owned = _ChatRoom.divesting = false;
                  } //synchronized(_ChatRoom)
                  if (whichSemaphore == null) return;
                  synchronized(whichSemaphore)
                  {
                     whichSemaphore.decreaseCount();
                     if (whichSemaphore.zero()) {
whichSemaphore.notify(); }
                  } //synchronized(whichSemaphore)
               } catch (RTIexception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestAttributeOwnershipRelease
      public void
      confirmAttributeOwnershipAcquisitionCancellation(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotCanceled,
             FederateInternalError
      {
         final aChatRoom _ChatRoom = SeekChatRoom(theObject);
         if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unknown ChatRoom offered");
         if (!theAttributes.containsAll(_oahs_ChatRoom)) throw new
AttributeNotRecognized("Unexpected attribute set cancelled");
         if (_ChatRoom.owned) throw new
AttributeAlreadyOwned("ChatRoom already owned");
         throw new AttributeAcquisitionWasNotCanceled("I don't think
so...");
      } //method confirmAttributeOwnershipAcquisitionCancellation
/**
      public void
      doInformOwnership(
         final ObjectInstanceHandle theObject,
         final AttributeHandle      theAttribute,
         final boolean              isUnowned,
         final boolean              isOwnedByRTI,
         final FederateHandle       theOwner)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             FederateInternalError
      {
      } //method doInformOwnership
 */
   } //class MyChatRoomOwnershipListener
   public class
   MyParticipantOwnershipListener
      extends FedAmbOwnershipListener
   {
      private Semaphore            whichSemaphore;
      private ObjectInstanceHandle whichObject;
      //The Semaphore and ObjectInstanceHandle serve two purposes:
      // - In Acquisition mode, Semaphore.value will be set once an
acquisitionNotification or
//         Unavailable callback is received for the
ObjectInstanceHandle, and then the Semaphore is notified.
      // - In Divestiture mode, each requestDivestitureConfirmation
and requestAttributeOwnershipRelease
//         results in a Semaphore.decreaseCount; once Semaphore.zero()
is true, it is notified.

      //Constructor
      public
      MyParticipantOwnershipListener(Semaphore aSemaphore,
ObjectInstanceHandle anObject)
      {
         whichSemaphore = aSemaphore;
         whichObject    = anObject;
      } //method MyParticipantOwnershipListener
      public void
      requestAttributeOwnershipAssumption(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   offeredAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeNotPublished,
             FederateInternalError
      {
         try {
            //Decline if we're in the process of shutting down (and
thus divesting)
            if (_me_shutting_down) return;
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unknown Participant offered");
            if (!offeredAttributes.containsAll(_oahs_Participant))
throw new AttributeNotRecognized("Unexpected attribute set offered");
            if (_Participant.owned) throw new
AttributeAlreadyOwned("Participant already owned");
            //Accept only if subscribed (and presumably up to date)
            //The inscope attribute is similar, but subscribed will do
just fine
            if (!_Participant.subscribed) return; //If not subscribed,
probably not up to date --decline

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  //Before acquiring, set up update regions so they do
not lapse during ownership transfer
                  synchronized(_Participant)
                  {

_rtiAmbassador.associateRegionsForUpdates(_Participant.handle,
_asrspl_Participant_nowhere);

_rtiAmbassador.associateRegionsForUpdates(_Participant.handle,
_asrspl_Participant_waiting_room);
                  } //synchronized(_Participant)

_rtiAmbassador.attributeOwnershipAcquisitionIfAvailable(_Participant.h
andle, _oahs_Participant); //or theObject
               } catch(Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestAttributeOwnershipAssumption
      public void
      requestDivestitureConfirmation(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   offeredAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             AttributeDivestitureWasNotRequested,
             FederateInternalError
      {
         try {
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unknown Participant offered");
            if (!offeredAttributes.containsAll(_oahs_Participant))
throw new AttributeNotRecognized("Unexpected attribute set
requested");
            if (!_Participant.owned) throw new
AttributeNotOwned("Participant not owned");

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
MyParticipantOwnershipListener: requestDivestitureConfirmation thread
begins");
               try {
                  //Confirm
                  synchronized(_Participant)
                  {

_rtiAmbassador.confirmDivestiture(_Participant.handle,
_oahs_Participant, null);
                     _Participant.owned = _Participant.divesting =
false;
                  } //synchronized(_Participant)
                  if (whichSemaphore == null) return;
                  synchronized(whichSemaphore)
                  {
                     whichSemaphore.decreaseCount();
                     if (whichSemaphore.zero()) {
whichSemaphore.notify(); }
                  } //synchronized(whichSemaphore)
               } catch(Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestDivestitureConfirmation
      public void
      attributeOwnershipAcquisitionNotification(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   securedAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAcquisitionWasNotRequested,
             AttributeAlreadyOwned,
             AttributeNotPublished,
             FederateInternalError
      {
         try {
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unknown Participant offered");
            if (!securedAttributes.containsAll(_oahs_Participant))
throw new AttributeNotRecognized("Unexpected attribute set acquired");
            if (_Participant.owned) throw new
AttributeAlreadyOwned("Participant already owned");
            //Must switch these right away, otherwise a Federate
Responder could be called before the thread has time to launch
            _Participant.owned = !(_Participant.inscope =
_Participant.divesting = false);
            //There are two circumstances where we acquire
Participants:
            //When we want to log in, and when another federate logs
out and shuts down.
            //In both cases we set up the ForUpdate Regions such that
the Participant
            //arrives associated with _nowhere and _waiting_room.
            //In the first circumstance, the
plnHLA_Participant_NameReservation waits on the
            //sem_Participant_acquisition and will move the
Participant to the _general ChatRoom.
            if (whichSemaphore != null)
            {
               synchronized(whichSemaphore)
               {
                  whichSemaphore.value =
(_Participant.handle.equals(whichObject));
                  if (whichSemaphore.value) whichSemaphore.notify();
               } //synchronized(whichSemaphore)
            } //if
            //Just in case we somehow managed to acquire whilst
switching to shutting down mode
            if (!_me_shutting_down) return;
            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               divestParticipants();
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method attributeOwnershipAcquisitionNotification
      public void
      attributeOwnershipUnavailable(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotRequested,
             FederateInternalError
      {
         try {
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unknown Participant offered");
            if (!theAttributes.containsAll(_oahs_Participant)) throw
new AttributeNotRecognized("Unexpected attribute set denied");
            if (_Participant.owned) throw new
AttributeAlreadyOwned("Participant already owned");
            if (whichSemaphore == null) return;
            synchronized(whichSemaphore)
            {
               whichSemaphore.value = false;
               if (_Participant.handle.equals(whichObject))
whichSemaphore.notify();
            } //synchronized(whichSemaphore)
         } catch(Exception intercepted) {
         } finally {
         } //try
      } //method attributeOwnershipUnavailable
      public void
      requestAttributeOwnershipRelease(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   candidateAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             FederateInternalError
      {
         try {
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unknown Participant offered");
            if (!candidateAttributes.containsAll(_oahs_Participant))
throw new AttributeNotRecognized("Unexpected attribute set
requested");
            if (!_Participant.owned) throw new
AttributeNotOwned("Participant not owned");
            //If request targets the logged-in _me, refuse (there is
no RTI call to tell the requester to piss off)
            //Should be just if (_Participant.equals(_me)) since _me
is just a placeholder
            //Participant object (not in the HLA fed) when the
federate is not logged in
            if (_me_logged_in && _Participant.equals(_me))
            {
               return;
            } //if
            //Otherwise, acquiesce
            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  if
(!_oahs_Participant.containsAll(_rtiAmbassador.attributeOwnershipDives
titureIfWanted(_Participant.handle, _oahs_Participant))) return;
                  //Success!
                  synchronized(_Participant)
                  {
                     _Participant.owned = _Participant.divesting =
_Participant.inscope = false;
                     //Region associations are automatically lost
along with ownership
                  } //synchronized(_Participant)
                  if (whichSemaphore == null) return;
                  synchronized(whichSemaphore)
                  {
                     whichSemaphore.decreaseCount();
                     if (whichSemaphore.zero()) {
whichSemaphore.notify(); }
                  } //synchronized(whichSemaphore)
               } catch (RTIexception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method requestAttributeOwnershipRelease
      public void
      confirmAttributeOwnershipAcquisitionCancellation(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotCanceled,
             FederateInternalError
      {
         try {
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unknown Participant offered");
            if (!theAttributes.containsAll(_oahs_Participant)) throw
new AttributeNotRecognized("Unexpected attribute set cancelled");
            if (_Participant.owned) throw new
AttributeAlreadyOwned("Participant already owned");
            throw new AttributeAcquisitionWasNotCanceled("I don't
think so...");
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method confirmAttributeOwnershipAcquisitionCancellation
/**
      public void
      doInformOwnership(
         final ObjectInstanceHandle theObject,
         final AttributeHandle      theAttribute,
         final boolean              isUnowned,
         final boolean              isOwnedByRTI,
         final FederateHandle       theOwner)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             FederateInternalError
      {
      } //method doInformOwnership
 */
   } //class MyParticipantOwnershipListener

   //Interaction Scope Advisories
   public class
   MyCommunicationAdvisoryResponder
      extends FedAmbInteractionAdvisoryResponder
   {
      protected void
      doRelevance(
         InteractionClassHandle theHandle,
         boolean                relevant)
      throws InteractionClassNotPublished,
             FederateInternalError
      {
         _alone = !relevant;
      } //method doRelevance
   } //class MyCommunicationAdvisoryResponder
   //Attribute Scope Advisories

   public class
   MyParticipantAttributeScopeListener
      extends FedAmbAttributeScopeAdvisoryListener
   {
      /**
       * Default constructor in use.
       */

      protected void
      doScope(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes,
         boolean              inScope)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotSubscribed,
             FederateInternalError
      {
         try {
            //The Participant has just come into or gone out of scope
--either we or it has changed ChatRooms (it cannot have been truly
deleted)
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unexpected Participant handle");
            if
(!theAttributes.containsAll(_oahs_Participant_forUpdate)) throw new
AttributeNotRecognized("Unexpected attribute set provided");
            if (!_Participant.subscribed) throw new
AttributeNotSubscribed("Participant not subscribed");
            //If we could localDelete Participants as they go out of
scope, we would always get
            //a Discovery right before the InScope callback; but we
can't do that because of the
            //pRTI RTIambassador-Federate Service Thread synch bug
(putting the Federate Service
            //Thread in any kind of synch-wait state (a Semaphore,
say) causes a federate-triggering
            //RTIambassador call by *any* thread to hang, even if the
latter RTIambassador-caller
            //isn't owning any monitors).
            //So we use the inScope property of aParticipant to work
around it.
            //Note that we get advisories even for owned objects
            _Participant.inscope = inScope;
            //Strip leading character
            final String theParticipantName =
_Participant.name.toString().substring(1);
```

```
            if (inScope)
            {
               //Freshly discovered object, or object that went out of
and back in scope
               //_Participant.subscribed, handle and name are set
(owned, divesting at default);
               //logged_in and chat_room_slot will have to await the
update listener
               //A newly discovered _Participant will have a
chat_room_slot of slot_nowhere_ChatRoom,
               //which is not possible once we get at least one update
(because no federate ever
               //subscribes to the nowhere ChatRoom)
               //
               //Maintain list of Participants (within the current
ChatRoom)
               final boolean mustAdd = _me_logged_in &&
_Participant.chat_room_slot.equals(_me.chat_room_slot);
               if (mustAdd)
               {
                  SwingUtilities.invokeLater(new Runnable() { public
void run() {
                     try {
                        //Note that we skip the <All> item
                        for (int i = 1; i < lstSendTo.getItemCount();
i++)
                        {
                           if
(theParticipantName.compareTo((String)lstSendTo.getItemAt(i)) == 0)
                           {
                              //The Participant is already listed
                              return;
                           } else if
(theParticipantName.compareTo((String)lstSendTo.getItemAt(i)) < 0)
                           {
                              //Previously unknown Participant, who
sorts before the current one (i)

lstSendTo.insertItemAt(theParticipantName, i);
                              lblStatus.setText(theParticipantName + "
has joined.");
                              return;
                           } //if
                        } //for
                        //If we make it through the list, must append
the previously unknown Participant
                        lstSendTo.insertItemAt(theParticipantName,
lstSendTo.getItemCount());
                        lblStatus.setText(theParticipantName + " has
joined.");
                     } finally {
                     } //try
                  } } ); //Runnable
               } else {
               } //if
            } else {
               //Maintain list of Participants (within the current
ChatRoom)
               //Because the _Participant will come back into scope
*before* we get an Update,
               //we'll mark it as "nowhere" so it behaves as a newly
discovered one should
               //it come back into scope
               final boolean mustAdvise = _me_logged_in &&
_Participant.chat_room_slot.equals(_me.chat_room_slot);

_Participant.chat_room_slot.setValue(_slot_nowhere_ChatRoom);
               SwingUtilities.invokeLater(new Runnable() { public void
run() {
                  if (mustAdvise) lblStatus.setText(theParticipantName
+ " has left.");
                  lstSendTo.removeItem(theParticipantName);
               } } ); //Runnable

               //What we wanted to do here was localDelete the
_Participant that just went out of scope.
               //We would have had to ask another thread to do this
RTIambassador call, and we would have
               //had to wait for that other thread to conclude,
otherwise the _Participant could come back
               //into scope (and trigger this listener again) before
the other thread had time to localDelete,
               //leading to a situation where the RTI thinks we know
the _Participant but we've
               //already stricken it off our list...
               //However, the pRTI RTIambassador-Federate Service
Thread synch bug is such that if we
               //put the Federate Service Thread in any kind of synch-
wait state (a Semaphore, say),
               //a federate-triggering RTIambassador call by *any*
thread hangs, even if the latter
               //RTIambassador-caller isn't owning any monitors.
               //Conclusion: We cannot localDelete at all.
            } //if
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method doScope
   } //class MyParticipantAttributeScopeListener
   //Attribute Updates (Listen and Respond)

   public class
   MyChatRoomRegistryInstanceAttributeListener
      extends FedAmbInstanceAttributeListener
   {
      protected void
      doUpdate(
         ObjectInstanceHandle    theObject,
         AttributeHandleValueMap theAttributes,
         byte[]                  userSuppliedTag,
         OrderType               sentOrdering,
         TransportationType      theTransport,
         LogicalTime             theTime,
         OrderType               receivedOrdering,
         MessageRetractionHandle retractionHandle,
         RegionHandleSet         sentRegions)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotSubscribed,
             InvalidLogicalTime,
             FederateInternalError
      {
         try {
            if (!theObject.equals(_ChatRoomRegistry.handle)) throw new
ObjectInstanceNotKnown("Unexpected ChatRoomRegistry handle");
            if
(!theAttributes.keySet().containsAll(_oahs_ChatRoomRegistry_forUpdate)
) throw new AttributeNotRecognized("Unexpected attribute set
provided");
            if (_ChatRoomRegistry.owned) throw new
FederateInternalError("ChatRoomRegistry owned");
            if (!_ChatRoomRegistry.subscribed) throw new
AttributeNotSubscribed("ChatRoomRegistry not subscribed");

            //HLAprivilegeToDeleteObject has no content, so we won't
decode it

_ChatRoomRegistry.list.decode((byte[])theAttributes.get(_oah_ChatRoomR
egistry_list));
         } catch (RTIexception intercepted) {
         } finally {
         } //try
      } //method doUpdate
   } //class MyChatRoomRegistryInstanceAttributeListener
   public class
   MyChatRoomInstanceAttributeListener
      extends FedAmbInstanceAttributeListener
   {
      protected void
      doUpdate(
         ObjectInstanceHandle    theObject,
         AttributeHandleValueMap theAttributes,
         byte[]                  userSuppliedTag,
         OrderType               sentOrdering,
         TransportationType      theTransport,
         LogicalTime             theTime,
         OrderType               receivedOrdering,
         MessageRetractionHandle retractionHandle,
         RegionHandleSet         sentRegions)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotSubscribed,
             InvalidLogicalTime,
             FederateInternalError
      {
         try {
            final aChatRoom _ChatRoom = SeekChatRoom(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("Unknown ChatRoom supplied");
            if
(!theAttributes.keySet().containsAll(_oahs_ChatRoom_forUpdate)) throw
new AttributeNotRecognized("Unexpected attribute set supplied");
            if (!_ChatRoom.subscribed) throw new
AttributeNotSubscribed("ChatRoom not subscribed");
            //No need to thread off since no RTI calls
            synchronized(_ChatRoom)
            {
               //Name is a true attribute, not the object's HLA name

_ChatRoom.name.decode((byte[])theAttributes.get(_oah_ChatRoom_name));

_ChatRoom.slot.decode((byte[])theAttributes.get(_oah_ChatRoom_slot));
               //Alternately, we could load the lstChatRooms at log-in
time...
               if
((_ChatRoom.name.toString().equals(_name_general_ChatRoom)) ||
(_ChatRoom.name.toString().equals(_name_waiting_room_ChatRoom)))
return;
               final String theChatRoomName =
_ChatRoom.name.toString().substring(1);
```

```
               SwingUtilities.invokeLater(new Runnable() { public void
run() {
                  //Note that we skip the <General> item
                  for (int i = 1; i < lstChatRooms.getItemCount();
i++)
                  {
                     //If already listed, done
                     if
(theChatRoomName.compareTo((String)lstChatRooms.getItemAt(i)) == 0)
return;
                     //Point of insertion found
                     if
(theChatRoomName.compareTo((String)lstChatRooms.getItemAt(i)) < 0)
                     {
                        lstChatRooms.insertItemAt(theChatRoomName, i);
                        return;
                     } //if
                  } //for
                  //List scanned without finding insertion point:
append
                  lstChatRooms.insertItemAt(theChatRoomName,
lstChatRooms.getItemCount());
               } } ); //Runnable
            } //synchronized(_ChatRoom)
         } catch (RTIexception intercepted) {
         } finally {
         } //try
      } //method doUpdate
   } //class MyChatRoomInstanceAttributeListener
   public class
   MyParticipantInstanceAttributeListener
      extends FedAmbInstanceAttributeListener
   {
      protected void
      doUpdate(
         ObjectInstanceHandle    theObject,
         AttributeHandleValueMap theAttributes,
         byte[]                  userSuppliedTag,
         OrderType               sentOrdering,
         TransportationType      theTransport,
         LogicalTime             theTime,
         OrderType               receivedOrdering,
         MessageRetractionHandle retractionHandle,
         RegionHandleSet         sentRegions)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotSubscribed,
             InvalidLogicalTime,
             FederateInternalError
      {
         try {
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Unknown Participant supplied");
            if
(!theAttributes.keySet().containsAll(_oahs_Participant_forUpdate))
throw new AttributeNotRecognized("Unexpected attribute set supplied");
            if (!_Participant.subscribed) throw new
AttributeNotSubscribed("Participant not subscribed");
            //Does this need to be threaded off?
            synchronized(_Participant)
            {
               //Name updated at Discovery time
//
_Participant.name.setValue(_rtiAmbassador.getObjectInstanceName(_theOb
ject));
               _Participant.logged_in.decode(
(byte[])theAttributes.get(_oah_Participant_logged_in));
               _Participant.user_handle.decode(
(byte[])theAttributes.get(_oah_Participant_user_handle));

_Participant.chat_room_slot.decode((byte[])theAttributes.get(_oah_Part
icipant_chat_room_slot));
               //Ideally, it would make more sense to maintain
lstSendTo on the Scope Advisory callbacks;
               //however, when those first occur, we do not know the
Participant's attributes yet, so we can't
               //tell between those in the "waiting_room" and those in
our ChatRoom.
               //When a Participant logs out (from our ChatRoom), it
moves from a given ChatRoom to the
               //"waiting_room" by first withdrawing to "nowhere", so
it will trigger Scope Advisories
               //twice (since we subscribe to "waiting_room" and our
current ChatRoom at all times).
//             if (_me_logged_in &&
(_Participant.chat_room_slot.getValue() != 0))
//             if (!_me_logged_in) return;
               final String theParticipantName =
_Participant.name.toString().substring(1);
               //When logged out, _me.chat_room_slot would be
waiting_room, so we don't want to add those
               final boolean mustAdd = _me_logged_in &&
_Participant.chat_room_slot.equals(_me.chat_room_slot);
```

```
               SwingUtilities.invokeLater(new Runnable() { public void
run() {
                  try {
                     //Note that we skip the <All> item
                     for (int i = 1; i < lstSendTo.getItemCount();
i++)
                     {
                        if
(theParticipantName.compareTo((String)lstSendTo.getItemAt(i)) == 0)
                        {
                           //The Participant is already listed
                           if (mustAdd) return;
                           lstSendTo.remove(i);
                           if (_me_logged_in)
lblStatus.setText(theParticipantName + " has left.");
                           return;
                        } else if
(theParticipantName.compareTo((String)lstSendTo.getItemAt(i)) < 0)
                        {
                           //Previously unknown Participant, who sorts
before the current one (i)
                           if (!mustAdd) return;
                           lstSendTo.insertItemAt(theParticipantName,
i);

                           lblStatus.setText(theParticipantName + "
has joined.");
                           return;
                        } //if
                     } //for
                     if (!mustAdd) return;
                     //If we make it through the list, must append the
previously unknown Participant
                     lstSendTo.insertItemAt(theParticipantName,
lstSendTo.getItemCount());
                     lblStatus.setText(theParticipantName + " has
joined.");
                  } finally {
                  } //try
               } } ); //Runnable
            } //synchronized(_Participant)
         } catch (RTIexception intercepted) {
         } finally {
         } //try
      } //method doUpdate
   } //class MyParticipantInstanceAttributeListener
   public class
   MyChatRoomRegistryInstanceAttributeResponder
      extends FedAmbInstanceAttributeResponder
   {
      public void
      provideAttributeValueUpdate(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             FederateInternalError
      {
         try {
            if (!theObject.equals(_ChatRoomRegistry.handle)) throw new
ObjectInstanceNotKnown("Unexpected ChatRoomRegistry handle");
            if
(!theAttributes.containsAll(_oahs_ChatRoomRegistry_forUpdate)) throw
new AttributeNotRecognized("Unexpected attribute set requested");
            if (!_ChatRoomRegistry.owned) throw new
AttributeNotOwned("ChatRoomRegistry not owned");
//          if (!_ChatRoomRegistry.subscribed) throw new
FederateInternalError("ChatRoomRegistry not subscribed");

            //If not threaded off, this throws RTIinternalError:
Concurrent access attempted to <method name>
            new Thread() { public void run() {
               try {
                  synchronized(_ChatRoomRegistry)
                  {
                     final AttributeHandleValueMap
_ahvm_attributeValues =
_rtiAmbassador.getAttributeHandleValueMapFactory().create(_oahs_ChatRo
omRegistry_forUpdate.size());
//
_ahvm_attributeValues.put(_oah_ChatRoomRegistry_DeletePrivilege,
null); //HLAprivilegeToDeleteObject is of undefined type (it has no
content)

_ahvm_attributeValues.put(_oah_ChatRoomRegistry_list,
_ChatRoomRegistry.list.toByteArray());

_rtiAmbassador.updateAttributeValues(_ChatRoomRegistry.handle,
_ahvm_attributeValues, null);
                  } //synchronized(_ChatRoomRegistry)
               } catch (Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method provideAttributeValueUpdate
   } //class MyChatRoomRegistryInstanceAttributeResponder
   public class
   MyChatRoomInstanceAttributeResponder
      extends FedAmbInstanceAttributeResponder
   {
      public void
      provideAttributeValueUpdate(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             FederateInternalError
      {
         try {
            final aChatRoom _ChatRoom = SeekChatRoom(theObject);
            if (_ChatRoom == null) throw new
ObjectInstanceNotKnown("ChatRoom instance not known");
            if (!theAttributes.containsAll(_oahs_ChatRoom_forUpdate))
throw new AttributeNotRecognized("Unexpected attribute set
requested");
            if (!_ChatRoom.owned) throw new
AttributeNotOwned("Requested ChatRoom not owned");

            new Thread() { public void run() {
               try {
                  synchronized(_ChatRoom)
                  {
                     final AttributeHandleValueMap
_ahvm_attributeValues =
_rtiAmbassador.getAttributeHandleValueMapFactory().create(_oahs_ChatRo
om_forUpdate.size());
                     _ahvm_attributeValues.put(_oah_ChatRoom_name,
_ChatRoom.name.toByteArray());
                     _ahvm_attributeValues.put(_oah_ChatRoom_slot,
_ChatRoom.slot.toByteArray());
                     //If not threaded off, this throws
RTIinternalError: Concurrent access attempted to <method name>

_rtiAmbassador.updateAttributeValues(_ChatRoom.handle,
_ahvm_attributeValues, null);
                  } //synchronized(_ChatRoom)
               } catch (Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method provideAttributeValueUpdate
   } //class MyChatRoomInstanceAttributeResponder
   public class
   MyParticipantInstanceAttributeResponder
      extends FedAmbInstanceAttributeResponder
   {
      public void
      provideAttributeValueUpdate(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             FederateInternalError
      {
         try {
            final aParticipant _Participant =
SeekParticipant(theObject);
            if (_Participant == null) throw new
ObjectInstanceNotKnown("Participant instance not known");
            if
(!theAttributes.containsAll(_oahs_Participant_forUpdate)) throw new
AttributeNotRecognized("Unexpected attribute set requested");
            if (!_Participant.owned) throw new
AttributeNotOwned("Requested Participant not owned");

            //We already knew that _rtiAmbassador calls from within
_fedAmbassador callbacks had to be threaded off
            //to avoid "RTIinternalError: Concurrent access attempted
to <method name>"; now a bug in pRTI causes
            //ANY _rtiAmbassador-calling thread to freeze if it the
call triggers any _fedAmbassador callbacks and the
            //federate thread is currently waiting for a
synchronization monitor.
            //So we must avoid having the federate service thread
going into a wait state, which means more threading off!
            //(Or, in this case, moving the synchronization call into
the child thread)
```

```
            new Thread() { public void run() {
               try {
                  //No need to synchronize earlier on _Participant
since the discovery and ownership handlers also synchronize on
_theParticipants
                  //It is crucial to synchronize here, however, since
the object's registration may trigger this handler right away
                  //(because of Auto-Provide) --and the object cannot
fill its user_handle field in the same atomic operation.
                  synchronized(_Participant)
                  {
                     final AttributeHandleValueMap
_ahvm_attributeValues =
_rtiAmbassador.getAttributeHandleValueMapFactory().create(_oahs_Partic
ipant_forUpdate.size());

_ahvm_attributeValues.put(_oah_Participant_logged_in,
_Participant.logged_in.toByteArray());

_ahvm_attributeValues.put(_oah_Participant_user_handle,
_Participant.user_handle.toByteArray());

_ahvm_attributeValues.put(_oah_Participant_chat_room_slot,
_Participant.chat_room_slot.toByteArray());


_rtiAmbassador.updateAttributeValues(_Participant.handle,
_ahvm_attributeValues, null);
                  } //synchronized(_Participant)
               } catch (Exception ignored) {
               } finally {
               } //try
            } }.start(); //Thread
         } catch (Exception intercepted) {
         } finally {
         } //try
      } //method provideAttributeValueUpdate
   } //class MyParticipantInstanceAttributeResponder
   /**
    * Entry point for java exec command.
    * args[0] (optional) is the RTI host ("localhost" by default)
    * args[1] (optional) is the FDD file path (may be relative or
absolute; "MyChat.xml" by default)
    * args[2] (optional) is the federation execution name
("MyChatRoom" by default)
    * args[3] (optional) is the federate name ("MyChatter" by default)
    * @param args the String[] command line arguments
    */
   public static void main(String args[])
   {
      new MyChat(args).show();
   }

   // Variables declaration - do not modify
   private javax.swing.JButton btnLogon;
   private javax.swing.JButton btnNewChatRoom;
   private javax.swing.JButton btnSendMessage;
   private javax.swing.JPanel jPanel1;
   private javax.swing.JPanel jPanel2;
   private javax.swing.JPanel jPanel3;
   private javax.swing.JPanel jPanel4;
   private javax.swing.JPanel jPanel5;
   private javax.swing.JPanel jPanel6;
   private javax.swing.JPanel jPanel7;
   private javax.swing.JLabel lblChatRoom;
   private javax.swing.JLabel lblSendTo;
   private javax.swing.JLabel lblStatus;
   private javax.swing.JComboBox lstChatRooms;
   private javax.swing.JComboBox lstSendTo;
   private javax.swing.JTextArea txtArea;
   private javax.swing.JTextField txtMessage;
   private javax.swing.JTextField txtUsername;
   // End of variables declaration
}
//end MyChat
```

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Annex F – The JACK Chat Client

The JACK Chat Client is a command-line user-interface (CLI) application. This was done simply to provide a visual distinction between the two clients; nothing prevents JACK from using a GUI. However, one notes that JACK development cannot be conducted from within a Java IDE, since JAL is no longer Java. One would have to develop the GUI separately and then import it into JACK.

On the other hand, JACK's built-in thread handling simplifies cross-task synchronization considerably. We started off by importing blocks of the Java client code, but soon realized that it was too "lumpy"; that is to say, tasks had not been broken down into small enough component steps. The way JACK implements semaphores, among other things, forced us to re-distribute the code between the plans. The end result is quite pleasing, JACK plans being a lot easier to read than our original Java chat client code.

The first part of this annex documents the `capHLA1516` capability, which is the re-usable part of the JACK-HLA interface. The second part details the JACK Chat Client itself.

Part One – The capHLA1516 Capability

The JACK `capHLA1516` capability acts as an adaptor between JACK and HLA. Because JACK introduces a lot of automatic code, rather than give a full textual listing of the various files that make up the JACK Chat client, we've opted for a summary description similar to the arborescent view used by the JACK Development Environment.

```
// File: HLA1516.prj
"ProjectName" node:  HLA1516
   "Documentation" node
      This is the JACK Repository project file for the HLA1516
package.
      See the "HLA1516 Capability Read Me.txt" file (under Other
Files) for details.

      Daniel U. Thibault
      Daniel.Thibault@DRDC-RDDC.GC.Ca
      2004 December 03
      revised 2004 January 13
"Design Views" node
   "Overview" node
      "Documentation" node
         Overview of the capHLA1516 capability's architecture
"Agent Model" node
   "Agent Types" node
      (empty)
   "Capability Types" node
      "HLA1516" node
         "capHLA1516"
```

```
"Plan Types" node
   "HLA1516" node
      "plnHLAannounceSynchronizationPoint"
      "plnHLAattributeIsNotOwned"
      "plnHLAattributeIsOwnedByRTI"
      "plnHLAattributeOwnershipAcquisitionNotification"
      "plnHLAattributeOwnershipUnavailable"
      "plnHLAattributesInScope"
      "plnHLAattributesOutOfScope"
      "plnHLAconfirmAttributeOwnershipAcquisitionCancellation"
      "plnHLAdiscoverObjectInstance"
      "plnHLAfederationNotRestored"
      "plnHLAfederationNotSaved"
      "plnHLAfederationRestoreBegun"
      "plnHLAfederationRestored"
      "plnHLAfederationRestoreStatusResponse"
      "plnHLAfederationSaved"
      "plnHLAfederationSaveStatusResponse"
      "plnHLAfederationSynchronized"
      "plnHLAinformAttributeOwnership"
      "plnHLAinitiateFederateRestore"
      "plnHLAinitiateFederateSave"
      "plnHLAobjectInstanceNameReservationFailed"
      "plnHLAobjectInstanceNameReservationSucceeded"
      "plnHLAprovideAttributeValueUpdate"
      "plnHLAreceiveInteraction"
      "plnHLAreflectAttributeValues"
      "plnHLAremoveObjectInstance"
      "plnHLArequestAttributeOwnershipAssumption"
      "plnHLArequestAttributeOwnershipRelease"
      "plnHLArequestDivestitureConfirmation"
      "plnHLArequestFederationRestoreFailed"
      "plnHLArequestFederationRestoreSucceeded"
      "plnHLArequestRetraction"
      "plnHLAstartRegistrationForObjectClass"
      "plnHLAstopRegistrationForObjectClass"
      "plnHLAsynchronizationPointRegistrationFailed"
      "plnHLAsynchronizationPointRegistrationSucceeded"
      "plnHLAtimeAdvanceGrant"
      "plnHLAtimeConstrainedEnabled"
      "plnHLAtimeRegulationEnabled"
      "plnHLAturnInteractionsOff"
      "plnHLAturnInteractionsOn"
      "plnHLAturnUpdatesOffForObjectInstance"
      "plnHLAturnUpdatesOnForObjectInstance"
```

```
"Event Types" node
   "HLA1516" node
      "evtHLAannounceSynchronizationPoint"
      "evtHLAattributeIsNotOwned"
      "evtHLAattributeIsOwnedByRTI"
      "evtHLAattributeOwnershipAcquisitionNotification"
      "evtHLAattributeOwnershipUnavailable"
      "evtHLAattributesInScope"
      "evtHLAattributesOutOfScope"
      "evtHLAconfirmAttributeOwnershipAcquisitionCancellation"
      "evtHLAdiscoverObjectInstance"
      "evtHLAfederationNotRestored"
      "evtHLAfederationNotSaved"
      "evtHLAfederationRestoreBegun"
      "evtHLAfederationRestored"
      "evtHLAfederationRestoreStatusResponse"
      "evtHLAfederationSaved"
      "evtHLAfederationSaveStatusResponse"
      "evtHLAfederationSynchronized"
      "evtHLAinformAttributeOwnership"
      "evtHLAinitiateFederateRestore"
      "evtHLAinitiateFederateSave"
      "evtHLAobjectInstanceNameReservationFailed"
      "evtHLAobjectInstanceNameReservationSucceeded"
      "evtHLAprovideAttributeValueUpdate"
      "evtHLAreceiveInteraction"
      "evtHLAreflectAttributeValues"
      "evtHLAremoveObjectInstance"
      "evtHLArequestAttributeOwnershipAssumption"
      "evtHLArequestAttributeOwnershipRelease"
      "evtHLArequestDivestitureConfirmation"
      "evtHLArequestFederationRestoreFailed"
      "evtHLArequestFederationRestoreSucceeded"
      "evtHLArequestRetraction"
      "evtHLAstartRegistrationForObjectClass"
      "evtHLAstopRegistrationForObjectClass"
      "evtHLAsynchronizationPointRegistrationFailed"
      "evtHLAsynchronizationPointRegistrationSucceeded"
      "evtHLAtimeAdvanceGrant"
      "evtHLAtimeConstrainedEnabled"
      "evtHLAtimeRegulationEnabled"
      "evtHLAturnInteractionsOff"
      "evtHLAturnInteractionsOn"
      "evtHLAturnUpdatesOffForObjectInstance"
      "evtHLAturnUpdatesOnForObjectInstance"
   "Named Data" node
      "HLA1516" node
         "blfHLA datHLA"
   "Data Model" node
      "Beliefset Types" node
         "HLA1516" node
            "blfHLA"
   "View Types" node
      (empty)
   "External Classes" node
      (empty)
"Other Files" node
   "HLA1516 Capability Read Me.txt"
//end HLA1516
```

The capHLA1516.cap file contains large boiler-plate blocks; after the comment header (which explains in detail how to use the capability), there are long lists of handled events, posted events, and used plans. In the inner HLAfederate class itself, there is a long list of private members holding the various Validation handler references, followed later on by a similar list of get/set methods. Finally, there is the FederateAmbassador implementation, which follows a simple design pattern of invoking the Validation handler if specified, and then posting the event that corresponds to the callback.

```
// File: capHLA1516.cap
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.FedAmb.*;
import hla.rti1516.*;

/**
Encapsulation of the HLA IEEE 1516 interface.

To use the capHLA1516 capability:

1) Import the capability into your project (see HLA1516 Capability
Read Me.txt for details).
2) Let the agent (or capability) have the capHLA1516 capability.
3) Create a Named Data instance of type
ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA and drag it to the
capability's external belief data import to replace the default one if
you wish.
4) At some point in your code (quite possibly the agent's constructor,
but this need not be), create one or more instances of the
capability's inner class capHLA1516.HLAfederate (see HLA1516
Capability Read Me.txt to learn how to invoke the constructor).

The <unique string identifier> used when creating the HLAfederate
instances is included as the identifier field of each of the HLA
events that will be posted to the enclosing agent/capability.
It is intended to be used by the latter to distinguish as needed
between the HLAfederate instances it may have created.
Each HLAfederate can be passed as a FederateAmbassador argument to the
RTIambassador's joinFederationExecution service invocation.
By creating multiple RTIambassador and HLAfederate instances, an agent
can thus play the roles of several HLA federates.
See HLA1516 Capability Read Me.txt to learn how to extend HLAfederate
as needed.

The capability's inner class (capHLA1516.HLAfederate) implements the
whole FederateAmbassador interface.
Each HLA callback is translated into a JACK HLA event and posted to
the enclosing agent (or capability).
Overloaded callbacks are rolled into a single event with appropriate
nulls.
```

```
The HLAfederate identifier can be queried with getIdentifier and even
changed with setIdentifier.
An RTIambassador field (rtiAmbassador) is supplied for convenience
(HLAfederate does not use it).
The imported belief data set datHLA stores the associations between
HLAfederate identifiers and instance references.
It also insures the uniqueness of identifiers within its enclosing
agent's scope; an attempt to create or rename an HLAfederate using an
already-extant identifier will throw a BeliefSetException.

DISPOSING OF THE HLAFEDERATE INSTANCE:

Once the HLAfederate instance has outlived its usefullness, it can be
removed from datHLA through the removeInstance query.
HLAfederate instances attempt to remove themselves from datHLA when
garbage-collected (System.gc()), just in case they were disposed of by
abnormal means.

WRITING PLANS TO HANDLE HLA EVENTS:

The enclosing agent/capability should declare it handles only those
HLA events that matter to it; the capability handles each of the
events it posts using irrelevant plans; this simple trick prevents the
run-time from complaining that some events are not handled.

When an agent handles multiple federates, plans can bind to the
correct HLAfederate instance by:

1) Declaring "HLA1516.capHLA1516.HLAfederate <HLAfederate_instance>;";
2) Reading the belief data set (add "#reads data blfHLA datHLA;" to
the plan code or simply drop the capability's imported datHLA on the
plan's Belief Data); and
3) Starting the context() method with:
       ( null != ( <HLAfederate_instance> = datHLA.getInstance(
<handled_event>.identifier ) ) )

Once this context step has succeeded, <HLAfederate_instance> is bound
to the HLAfederate instance reference that matches the event's
identifier field. Equivalently, you can declare an additional logical
variable Object <Object_instance> and start the context() with:

        datHLA.get( <handled_event>.identifier, <Object_instance> ) &&
       ( null != (<HLAfederate_instance> =
(HLAfederate)<Object_instance>.as_object()));

The latter form may be more convenient if you wish to typecast
directly to your HLAfederate sub-class --you'd replace the
(HLAfederate) typecast accordingly, of course.
```

```
WRITING HLA EVENT VALIDATORS:

Each of the 43 HLA events has a corresponding Validate interface in
the ca.gc.drdc_rddc.hla.rti1516.FedAmb package.
For example, evtHLAannounceSynchronizationPoint has a
ValidateAnnounceSynchronizationPoint interface.
To have the HLAfederate invoke a validation handler when it receives
the HLA callback (within the Federate Service Thread), you need only
register it with the HLAfederate instance at any time using the
corresponding set method (e.g.
setValidateAnnounceSynchronizationPoint()).

ON PLAYING WITH MULTIPLE FEDERATION EXECUTIONS AT ONCE:

The HLA spec and RTI implementations are quirky at this level.
Nothing prevents a single RTIambassador instance from creating and
deleting multiple federation executions, but it may join only one at a
time.
This is because the RTI identifies the federate with the RTIambassador
instance, and it considers the RTIambassador committed to the
federation execution it joined until it resigns from it.

ON THE USE OF IRRELEVANT PLANS:

In JACK, internal capabilities are always more prominent than plans,
so we have a small problem.
If we let capHLA1516 simply post the gamut of HLA events, the run-time
will complain that some events are not being handled unless the user
supplies "null plans" for each of those events he's not interested in.
This is an annoyance.

To solve this, we built into capHLA1516 an event-handling capability
for each of the HLA events.
None of the capability's internal plans actually *do* anything, which
is what we want for null handlers.
But because internal capabilities are more prominent than the agent's
plans, if the user wanted to write meaningful handlers for the HLA
events he would have to wrap them into a capability of his own, and
then make sure that his capability is more prominent than the
capHLA1516.
This is workable but unsafe.

To make capHLA1516 foolproof, we simply made each of our internal HLA
plans irrelevant --that is to say, they all return false as their
relevance() method.
This way, the run-time is satisfied, and the user can have his own
picked HLA handling plans wherever he wishes them to be.
Our plans will never be invoked and will thus always be glossed over
should they be more prominent.
The fact that otherwise-unhandled events end up with no applicable
plans at all does not bother JACK overmuch.
 */
```

```
public capability
capHLA1516
   extends Capability
{
   #handles external event evtHLAannounceSynchronizationPoint;
   #handles external event evtHLAattributeIsNotOwned;
   #handles external event evtHLAattributeIsOwnedByRTI;
   #handles external event
evtHLAattributeOwnershipAcquisitionNotification;
   #handles external event evtHLAattributeOwnershipUnavailable;
   #handles external event evtHLAattributesInScope;
   #handles external event evtHLAattributesOutOfScope;
   #handles external event
evtHLAconfirmAttributeOwnershipAcquisitionCancellation;
   #handles external event evtHLAdiscoverObjectInstance;
   #handles external event evtHLAfederationNotRestored;
   #handles external event evtHLAfederationNotSaved;
   #handles external event evtHLAfederationRestoreBegun;
   #handles external event evtHLAfederationRestored;
   #handles external event evtHLAfederationRestoreStatusResponse;
   #handles external event evtHLAfederationSaved;
   #handles external event evtHLAfederationSaveStatusResponse;
   #handles external event evtHLAfederationSynchronized;
   #handles external event evtHLAinformAttributeOwnership;
   #handles external event evtHLAinitiateFederateRestore;
   #handles external event evtHLAinitiateFederateSave;
   #handles external event evtHLAobjectInstanceNameReservationFailed;
   #handles external event
evtHLAobjectInstanceNameReservationSucceeded;
   #handles external event evtHLAprovideAttributeValueUpdate;
   #handles external event evtHLAreceiveInteraction;
   #handles external event evtHLAreflectAttributeValues;
   #handles external event evtHLAremoveObjectInstance;
   #handles external event evtHLArequestAttributeOwnershipAssumption;
   #handles external event evtHLArequestAttributeOwnershipRelease;
   #handles external event evtHLArequestDivestitureConfirmation;
   #handles external event evtHLArequestFederationRestoreFailed;
   #handles external event evtHLArequestFederationRestoreSucceeded;
   #handles external event evtHLArequestRetraction;
   #handles external event evtHLAstartRegistrationForObjectClass;
   #handles external event evtHLAstopRegistrationForObjectClass;
   #handles external event
evtHLAsynchronizationPointRegistrationFailed;
   #handles external event
evtHLAsynchronizationPointRegistrationSucceeded;
   #handles external event evtHLAtimeAdvanceGrant;
   #handles external event evtHLAtimeConstrainedEnabled;
   #handles external event evtHLAtimeRegulationEnabled;
   #handles external event evtHLAturnInteractionsOff;
   #handles external event evtHLAturnInteractionsOn;
   #handles external event evtHLAturnUpdatesOffForObjectInstance;
   #handles external event evtHLAturnUpdatesOnForObjectInstance;
   #posts external event evtHLAannounceSynchronizationPoint
evHLAannounceSynchronizationPoint;
   #posts external event evtHLAattributeIsNotOwned
evHLAattributeIsNotOwned;
   #posts external event evtHLAattributeIsOwnedByRTI
evHLAattributeIsOwnedByRTI;
   #posts external event
evtHLAattributeOwnershipAcquisitionNotification
evHLAattributeOwnershipAcquisitionNotification;
   #posts external event evtHLAattributeOwnershipUnavailable
evHLAattributeOwnershipUnavailable;
   #posts external event evtHLAattributesInScope
evHLAattributesInScope;
   #posts external event evtHLAattributesOutOfScope
evHLAattributesOutOfScope;
   #posts external event
evtHLAconfirmAttributeOwnershipAcquisitionCancellation
evHLAconfirmAttributeOwnershipAcquisitionCancellation;
   #posts external event evtHLAdiscoverObjectInstance
evHLAdiscoverObjectInstance;
   #posts external event evtHLAfederationNotRestored
evHLAfederationNotRestored;
   #posts external event evtHLAfederationNotSaved
evHLAfederationNotSaved;
   #posts external event evtHLAfederationRestoreBegun
evHLAfederationRestoreBegun;
   #posts external event evtHLAfederationRestored
evHLAfederationRestored;
   #posts external event evtHLAfederationRestoreStatusResponse
evHLAfederationRestoreStatusResponse;
   #posts external event evtHLAfederationSaved evHLAfederationSaved;
   #posts external event evtHLAfederationSaveStatusResponse
evHLAfederationSaveStatusResponse;
   #posts external event evtHLAfederationSynchronized
evHLAfederationSynchronized;
   #posts external event evtHLAinformAttributeOwnership
evHLAinformAttributeOwnership;
   #posts external event evtHLAinitiateFederateRestore
evHLAinitiateFederateRestore;
   #posts external event evtHLAinitiateFederateSave
evHLAinitiateFederateSave;
   #posts external event evtHLAobjectInstanceNameReservationFailed
evHLAobjectInstanceNameReservationFailed;
   #posts external event evtHLAobjectInstanceNameReservationSucceeded
evHLAobjectInstanceNameReservationSucceeded;
```

```
   #posts external event evtHLAprovideAttributeValueUpdate
evHLAprovideAttributeValueUpdate;
   #posts external event evtHLAreceiveInteraction
evHLAreceiveInteraction;
   #posts external event evtHLAreflectAttributeValues
evHLAreflectAttributeValues;
   #posts external event evtHLAremoveObjectInstance
evHLAremoveObjectInstance;
   #posts external event evtHLArequestAttributeOwnershipAssumption
evHLArequestAttributeOwnershipAssumption;
   #posts external event evtHLArequestAttributeOwnershipRelease
evHLArequestAttributeOwnershipRelease;
   #posts external event evtHLArequestDivestitureConfirmation
evHLArequestDivestitureConfirmation;
   #posts external event evtHLArequestFederationRestoreFailed
evHLArequestFederationRestoreFailed;
   #posts external event evtHLArequestFederationRestoreSucceeded
evHLArequestFederationRestoreSucceeded;
   #posts external event evtHLArequestRetraction
evHLArequestRetraction;
   #posts external event evtHLAstartRegistrationForObjectClass
evHLAstartRegistrationForObjectClass;
   #posts external event evtHLAstopRegistrationForObjectClass
evHLAstopRegistrationForObjectClass;
   #posts external event evtHLAsynchronizationPointRegistrationFailed
evHLAsynchronizationPointRegistrationFailed;
   #posts external event
evtHLAsynchronizationPointRegistrationSucceeded
evHLAsynchronizationPointRegistrationSucceeded;
   #posts external event evtHLAtimeAdvanceGrant evHLAtimeAdvanceGrant;
   #posts external event evtHLAtimeConstrainedEnabled
evHLAtimeConstrainedEnabled;
   #posts external event evtHLAtimeRegulationEnabled
evHLAtimeRegulationEnabled;
   #posts external event evtHLAturnInteractionsOff
evHLAturnInteractionsOff;
   #posts external event evtHLAturnInteractionsOn
evHLAturnInteractionsOn;
   #posts external event evtHLAturnUpdatesOffForObjectInstance
evHLAturnUpdatesOffForObjectInstance;
   #posts external event evtHLAturnUpdatesOnForObjectInstance
evHLAturnUpdatesOnForObjectInstance;
```

```
#uses plan plnHLAannounceSynchronizationPoint;
#uses plan plnHLAattributeIsNotOwned;
#uses plan plnHLAattributeIsOwnedByRTI;
#uses plan plnHLAattributeOwnershipAcquisitionNotification;
#uses plan plnHLAattributeOwnershipUnavailable;
#uses plan plnHLAattributesInScope;
#uses plan plnHLAattributesOutOfScope;
#uses plan plnHLAconfirmAttributeOwnershipAcquisitionCancellation;
#uses plan plnHLAdiscoverObjectInstance;
#uses plan plnHLAfederationNotRestored;
#uses plan plnHLAfederationNotSaved;
#uses plan plnHLAfederationRestoreBegun;
#uses plan plnHLAfederationRestored;
#uses plan plnHLAfederationRestoreStatusResponse;
#uses plan plnHLAfederationSaved;
#uses plan plnHLAfederationSaveStatusResponse;
#uses plan plnHLAfederationSynchronized;
#uses plan plnHLAinformAttributeOwnership;
#uses plan plnHLAinitiateFederateRestore;
#uses plan plnHLAinitiateFederateSave;
#uses plan plnHLAobjectInstanceNameReservationFailed;
#uses plan plnHLAobjectInstanceNameReservationSucceeded;
#uses plan plnHLAprovideAttributeValueUpdate;
#uses plan plnHLAreceiveInteraction;
#uses plan plnHLAreflectAttributeValues;
#uses plan plnHLAremoveObjectInstance;
#uses plan plnHLArequestAttributeOwnershipAssumption;
#uses plan plnHLArequestAttributeOwnershipRelease;
#uses plan plnHLArequestDivestitureConfirmation;
#uses plan plnHLArequestFederationRestoreFailed;
#uses plan plnHLArequestFederationRestoreSucceeded;
#uses plan plnHLArequestRetraction;
#uses plan plnHLAstartRegistrationForObjectClass;
#uses plan plnHLAstopRegistrationForObjectClass;
#uses plan plnHLAsynchronizationPointRegistrationFailed;
#uses plan plnHLAsynchronizationPointRegistrationSucceeded;
#uses plan plnHLAtimeAdvanceGrant;
#uses plan plnHLAtimeConstrainedEnabled;
#uses plan plnHLAtimeRegulationEnabled;
#uses plan plnHLAturnInteractionsOff;
#uses plan plnHLAturnInteractionsOn;
#uses plan plnHLAturnUpdatesOffForObjectInstance;
#uses plan plnHLAturnUpdatesOnForObjectInstance;

#imports data blfHLA datHLA();
```

```
   public HLAfederate
   getNewHLAfederate(String identifier)
      throws aos.jack.jak.beliefset.BeliefSetException
   {
      return new HLAfederate(identifier);
   }

    public class
   HLAfederate
      implements FederateAmbassador
      /**
       * Method signature conflicts prevent all Validate interfaces
from being
      * accommodated by a single class. If this had not been the case,
       * HLAfederate could have implemented all of them and used
itself as a
       * null handler. Instead we'll guard each invocation.
       */
   {
      //The instance's identifier
      private String _identifier;

       //Convenience RTIambassador reference
      public RTIambassador rtiAmbassador;
      //Validation handlers
      private
      ValidateAnnounceSynchronizationPoint
validateAnnounceSynchronizationPoint;
      private
      ValidateAttributeIsNotOwned validateAttributeIsNotOwned;
      private
      ValidateAttributeIsOwnedByRTI validateAttributeIsOwnedByRTI;
      private
      ValidateAttributeOwnershipAcquisitionNotification
validateAttributeOwnershipAcquisitionNotification;
      private
      ValidateAttributeOwnershipUnavailable
validateAttributeOwnershipUnavailable;
      private
      ValidateAttributesInScope validateAttributesInScope;
      private
      ValidateAttributesOutOfScope validateAttributesOutOfScope;
      private
      ValidateConfirmAttributeOwnershipAcquisitionCancellation
validateConfirmAttributeOwnershipAcquisitionCancellation;
      private
      ValidateDiscoverObjectInstance validateDiscoverObjectInstance;
      private
      ValidateFederationNotRestored validateFederationNotRestored;
      private
      ValidateFederationNotSaved validateFederationNotSaved;
      private
      ValidateFederationRestoreBegun validateFederationRestoreBegun;
      private
      ValidateFederationRestored validateFederationRestored;
      private
      ValidateFederationRestoreStatusResponse
validateFederationRestoreStatusResponse;
      private
      ValidateFederationSaved validateFederationSaved;
      private
      ValidateFederationSaveStatusResponse
validateFederationSaveStatusResponse;
      private
      ValidateFederationSynchronized validateFederationSynchronized;
      private
      ValidateInformAttributeOwnership
validateInformAttributeOwnership;
      private
      ValidateInitiateFederateRestore validateInitiateFederateRestore;
      private
      ValidateInitiateFederateSave validateInitiateFederateSave;
      private
      ValidateObjectInstanceNameReservationFailed
validateObjectInstanceNameReservationFailed;
      private
      ValidateObjectInstanceNameReservationSucceeded
validateObjectInstanceNameReservationSucceeded;
```

```
      private
      ValidateProvideAttributeValueUpdate
validateProvideAttributeValueUpdate;
      private
      ValidateReceiveInteraction validateReceiveInteraction;
      private
      ValidateReflectAttributeValues validateReflectAttributeValues;
      private
      ValidateRemoveObjectInstance validateRemoveObjectInstance;
      private
      ValidateRequestAttributeOwnershipAssumption
validateRequestAttributeOwnershipAssumption;
      private
      ValidateRequestAttributeOwnershipRelease
validateRequestAttributeOwnershipRelease;
      private
      ValidateRequestDivestitureConfirmation
validateRequestDivestitureConfirmation;
      private
      ValidateRequestFederationRestoreFailed
validateRequestFederationRestoreFailed;
      private
      ValidateRequestFederationRestoreSucceeded
validateRequestFederationRestoreSucceeded;
      private
      ValidateRequestRetraction validateRequestRetraction;
      private
      ValidateStartRegistrationForObjectClass
validateStartRegistrationForObjectClass;
      private
      ValidateStopRegistrationForObjectClass
validateStopRegistrationForObjectClass;
      private
      ValidateSynchronizationPointRegistrationFailed
validateSynchronizationPointRegistrationFailed;
      private
      ValidateSynchronizationPointRegistrationSucceeded
validateSynchronizationPointRegistrationSucceeded;
      private
      ValidateTimeAdvanceGrant validateTimeAdvanceGrant;
      private
      ValidateTimeConstrainedEnabled validateTimeConstrainedEnabled;
      private
      ValidateTimeRegulationEnabled validateTimeRegulationEnabled;
      private
      ValidateTurnInteractionsOff validateTurnInteractionsOff;
      private
      ValidateTurnInteractionsOn validateTurnInteractionsOn;
      private
      ValidateTurnUpdatesOffForObjectInstance
validateTurnUpdatesOffForObjectInstance;
      private
      ValidateTurnUpdatesOnForObjectInstance
validateTurnUpdatesOnForObjectInstance;
```

```
       /**
       * Constructor.
       * @param identifier A String used to distinguish this instance
from others.
       * @throws BeliefSetException if the identifier is already in
use
       */
      public
      HLAfederate(String identifier)
         throws aos.jack.jak.beliefset.BeliefSetException
      {
         if (datHLA.hasKey(identifier)) throw new
aos.jack.jak.beliefset.BeliefSetException("Identifier already in use:
'" + identifier + "'");
         _identifier = identifier;
         datHLA.add( _identifier, this );
      } //Constructor

       /**
       * Called by the garbage collector on this object before
disposing of it.
       * @throws Throwable if something goes wrong
       */
       protected void
      finalize()
          throws Throwable
      {
         datHLA.remove( _identifier, this );
      } //finalize

       /**
       * Gets the current identifier.
       * @return the current String identifier
       */
      public String
      getIdentifier()
      {
         return _identifier;
      }
      /**
       * Sets the identifier to the new value and returns the previous
one.
       * @param newIdentifier the new String identifier
       * @return the previous identifier
       * @throws BeliefSetException if the newIdentifier is already in
use
       */
      public String
      setIdentifier(String newIdentifier)
         throws aos.jack.jak.beliefset.BeliefSetException
      {
         //Is newIdentifier already in use?
         if (datHLA.hasKey(newIdentifier)) throw new
aos.jack.jak.beliefset.BeliefSetException("Identifier already in use:
'" + newIdentifier + "'");
         String r = _identifier;
         _identifier = newIdentifier;
         datHLA.remove( r, this );
         datHLA.add( _identifier, this );
         return r;
      }

      /**
       * ####################################
       * Validation handlers access functions
       * ####################################
       */

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateAnnounceSynchronizationPoint
      getValidateAnnounceSynchronizationPoint()
      {
         return validateAnnounceSynchronizationPoint;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateAnnounceSynchronizationPoint

setValidateAnnounceSynchronizationPoint(ValidateAnnounceSynchronizatio
nPoint newValidationHandler)
      {
         ValidateAnnounceSynchronizationPoint r =
validateAnnounceSynchronizationPoint;
         validateAnnounceSynchronizationPoint = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateAttributeIsNotOwned
      getValidateAttributeIsNotOwned()
      {
         return validateAttributeIsNotOwned;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateAttributeIsNotOwned
      setValidateAttributeIsNotOwned(ValidateAttributeIsNotOwned
newValidationHandler)
      {
         ValidateAttributeIsNotOwned r = validateAttributeIsNotOwned;
         validateAttributeIsNotOwned = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateAttributeIsOwnedByRTI
      getValidateAttributeIsOwnedByRTI()
      {
         return validateAttributeIsOwnedByRTI;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateAttributeIsOwnedByRTI
      setValidateAttributeIsOwnedByRTI(ValidateAttributeIsOwnedByRTI
newValidationHandler)
      {
         ValidateAttributeIsOwnedByRTI r =
validateAttributeIsOwnedByRTI;
         validateAttributeIsOwnedByRTI = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateAttributeOwnershipAcquisitionNotification
      getValidateAttributeOwnershipAcquisitionNotification()
      {
         return validateAttributeOwnershipAcquisitionNotification;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateAttributeOwnershipAcquisitionNotification

setValidateAttributeOwnershipAcquisitionNotification(ValidateAttribute
OwnershipAcquisitionNotification newValidationHandler)
      {
         ValidateAttributeOwnershipAcquisitionNotification r =
validateAttributeOwnershipAcquisitionNotification;
         validateAttributeOwnershipAcquisitionNotification =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateAttributeOwnershipUnavailable
      getValidateAttributeOwnershipUnavailable()
      {
         return validateAttributeOwnershipUnavailable;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateAttributeOwnershipUnavailable

setValidateAttributeOwnershipUnavailable(ValidateAttributeOwnershipUna
vailable newValidationHandler)
      {
         ValidateAttributeOwnershipUnavailable r =
validateAttributeOwnershipUnavailable;
         validateAttributeOwnershipUnavailable = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateAttributesInScope
      getValidateAttributesInScope()
      {
         return validateAttributesInScope;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateAttributesInScope
      setValidateAttributesInScope(ValidateAttributesInScope
newValidationHandler)
      {
         ValidateAttributesInScope r = validateAttributesInScope;
         validateAttributesInScope = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateAttributesOutOfScope
      getValidateAttributesOutOfScope()
      {
         return validateAttributesOutOfScope;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateAttributesOutOfScope
      setValidateAttributesOutOfScope(ValidateAttributesOutOfScope
newValidationHandler)
      {
         ValidateAttributesOutOfScope r =
validateAttributesOutOfScope;
         validateAttributesOutOfScope = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateConfirmAttributeOwnershipAcquisitionCancellation
      getValidateConfirmAttributeOwnershipAcquisitionCancellation()
      {
         return
validateConfirmAttributeOwnershipAcquisitionCancellation;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateConfirmAttributeOwnershipAcquisitionCancellation

setValidateConfirmAttributeOwnershipAcquisitionCancellation(ValidateCo
nfirmAttributeOwnershipAcquisitionCancellation newValidationHandler)
      {
         ValidateConfirmAttributeOwnershipAcquisitionCancellation r =
validateConfirmAttributeOwnershipAcquisitionCancellation;
         validateConfirmAttributeOwnershipAcquisitionCancellation =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateDiscoverObjectInstance
      getValidateDiscoverObjectInstance()
      {
         return validateDiscoverObjectInstance;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateDiscoverObjectInstance
      setValidateDiscoverObjectInstance(ValidateDiscoverObjectInstance
newValidationHandler)
      {
         ValidateDiscoverObjectInstance r =
validateDiscoverObjectInstance;
         validateDiscoverObjectInstance = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateFederationNotRestored
      getValidateFederationNotRestored()
      {
         return validateFederationNotRestored;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateFederationNotRestored
      setValidateFederationNotRestored(ValidateFederationNotRestored
newValidationHandler)
      {
         ValidateFederationNotRestored r =
validateFederationNotRestored;
         validateFederationNotRestored = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateFederationNotSaved
      getValidateFederationNotSaved()
      {
         return validateFederationNotSaved;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateFederationNotSaved
      setValidateFederationNotSaved(ValidateFederationNotSaved
newValidationHandler)
      {
         ValidateFederationNotSaved r = validateFederationNotSaved;
         validateFederationNotSaved = newValidationHandler;
         return r;
      }
```

```
	/**
	 * Gets the current Validation handler.
	 * @return the current Validation handler
	 */
	public ValidateFederationRestoreBegun
	getValidateFederationRestoreBegun()
	{
	   return validateFederationRestoreBegun;
	}

	/**
	 * Sets the Validation handler to the new value and returns the
previous one.
	 * @param newValidationHandler the new Validation handler
	 * @return the previous Validation handler
	 */
	public ValidateFederationRestoreBegun
	setValidateFederationRestoreBegun(ValidateFederationRestoreBegun
newValidationHandler)
	{
	   ValidateFederationRestoreBegun r =
validateFederationRestoreBegun;
	   validateFederationRestoreBegun = newValidationHandler;
	   return r;
	}

	/**
	 * Gets the current Validation handler.
	 * @return the current Validation handler
	 */
	public ValidateFederationRestored
	getValidateFederationRestored()
	{
	   return validateFederationRestored;
	}

	/**
	 * Sets the Validation handler to the new value and returns the
previous one.
	 * @param newValidationHandler the new Validation handler
	 * @return the previous Validation handler
	 */
	public ValidateFederationRestored
	setValidateFederationRestored(ValidateFederationRestored
newValidationHandler)
	{
	   ValidateFederationRestored r = validateFederationRestored;
	   validateFederationRestored = newValidationHandler;
	   return r;
	}
```

```
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateFederationRestoreStatusResponse
      getValidateFederationRestoreStatusResponse()
      {
         return validateFederationRestoreStatusResponse;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateFederationRestoreStatusResponse

setValidateFederationRestoreStatusResponse(ValidateFederationRestoreSt
atusResponse newValidationHandler)
      {
         ValidateFederationRestoreStatusResponse r =
validateFederationRestoreStatusResponse;
         validateFederationRestoreStatusResponse =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateFederationSaved
      getValidateFederationSaved()
      {
         return validateFederationSaved;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateFederationSaved
      setValidateFederationSaved(ValidateFederationSaved
newValidationHandler)
      {
         ValidateFederationSaved r = validateFederationSaved;
         validateFederationSaved = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateFederationSaveStatusResponse
      getValidateFederationSaveStatusResponse()
      {
         return validateFederationSaveStatusResponse;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateFederationSaveStatusResponse

setValidateFederationSaveStatusResponse(ValidateFederationSaveStatusRe
sponse newValidationHandler)
      {
         ValidateFederationSaveStatusResponse r =
validateFederationSaveStatusResponse;
         validateFederationSaveStatusResponse = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateFederationSynchronized
      getValidateFederationSynchronized()
      {
         return validateFederationSynchronized;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateFederationSynchronized
      setValidateFederationSynchronized(ValidateFederationSynchronized
newValidationHandler)
      {
         ValidateFederationSynchronized r =
validateFederationSynchronized;
         validateFederationSynchronized = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateInformAttributeOwnership
      getValidateInformAttributeOwnership()
      {
         return validateInformAttributeOwnership;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateInformAttributeOwnership

setValidateInformAttributeOwnership(ValidateInformAttributeOwnership
newValidationHandler)
      {
         ValidateInformAttributeOwnership r =
validateInformAttributeOwnership;
         validateInformAttributeOwnership = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateInitiateFederateRestore
      getValidateInitiateFederateRestore()
      {
         return validateInitiateFederateRestore;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateInitiateFederateRestore

setValidateInitiateFederateRestore(ValidateInitiateFederateRestore
newValidationHandler)
      {
         ValidateInitiateFederateRestore r =
validateInitiateFederateRestore;
         validateInitiateFederateRestore = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateInitiateFederateSave
      getValidateInitiateFederateSave()
      {
         return validateInitiateFederateSave;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateInitiateFederateSave
      setValidateInitiateFederateSave(ValidateInitiateFederateSave
newValidationHandler)
      {
         ValidateInitiateFederateSave r =
validateInitiateFederateSave;
         validateInitiateFederateSave = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateObjectInstanceNameReservationFailed
      getValidateObjectInstanceNameReservationFailed()
      {
         return validateObjectInstanceNameReservationFailed;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateObjectInstanceNameReservationFailed

setValidateObjectInstanceNameReservationFailed(ValidateObjectInstanceN
ameReservationFailed newValidationHandler)
      {
         ValidateObjectInstanceNameReservationFailed r =
validateObjectInstanceNameReservationFailed;
         validateObjectInstanceNameReservationFailed =
newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateObjectInstanceNameReservationSucceeded
      getValidateObjectInstanceNameReservationSucceeded()
      {
         return validateObjectInstanceNameReservationSucceeded;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateObjectInstanceNameReservationSucceeded

setValidateObjectInstanceNameReservationSucceeded(ValidateObjectInstan
ceNameReservationSucceeded newValidationHandler)
      {
         ValidateObjectInstanceNameReservationSucceeded r =
validateObjectInstanceNameReservationSucceeded;
         validateObjectInstanceNameReservationSucceeded =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateProvideAttributeValueUpdate
      getValidateProvideAttributeValueUpdate()
      {
         return validateProvideAttributeValueUpdate;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateProvideAttributeValueUpdate

setValidateProvideAttributeValueUpdate(ValidateProvideAttributeValueUp
date newValidationHandler)
      {
         ValidateProvideAttributeValueUpdate r =
validateProvideAttributeValueUpdate;
         validateProvideAttributeValueUpdate = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateReceiveInteraction
      getValidateReceiveInteraction()
      {
         return validateReceiveInteraction;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateReceiveInteraction
      setValidateReceiveInteraction(ValidateReceiveInteraction
newValidationHandler)
      {
         ValidateReceiveInteraction r = validateReceiveInteraction;
         validateReceiveInteraction = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateReflectAttributeValues
      getValidateReflectAttributeValues()
      {
         return validateReflectAttributeValues;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateReflectAttributeValues
      setValidateReflectAttributeValues(ValidateReflectAttributeValues
newValidationHandler)
      {
         ValidateReflectAttributeValues r =
validateReflectAttributeValues;
         validateReflectAttributeValues = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateRemoveObjectInstance
      getValidateRemoveObjectInstance()
      {
         return validateRemoveObjectInstance;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateRemoveObjectInstance
      setValidateRemoveObjectInstance(ValidateRemoveObjectInstance
newValidationHandler)
      {
         ValidateRemoveObjectInstance r =
validateRemoveObjectInstance;
         validateRemoveObjectInstance = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateRequestAttributeOwnershipAssumption
      getValidateRequestAttributeOwnershipAssumption()
      {
         return validateRequestAttributeOwnershipAssumption;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateRequestAttributeOwnershipAssumption

setValidateRequestAttributeOwnershipAssumption(ValidateRequestAttribut
eOwnershipAssumption newValidationHandler)
      {
         ValidateRequestAttributeOwnershipAssumption r =
validateRequestAttributeOwnershipAssumption;
         validateRequestAttributeOwnershipAssumption =
newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateRequestAttributeOwnershipRelease
      getValidateRequestAttributeOwnershipRelease()
      {
         return validateRequestAttributeOwnershipRelease;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateRequestAttributeOwnershipRelease

setValidateRequestAttributeOwnershipRelease(ValidateRequestAttributeOw
nershipRelease newValidationHandler)
      {
         ValidateRequestAttributeOwnershipRelease r =
validateRequestAttributeOwnershipRelease;
         validateRequestAttributeOwnershipRelease =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateRequestDivestitureConfirmation
      getValidateRequestDivestitureConfirmation()
      {
         return validateRequestDivestitureConfirmation;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateRequestDivestitureConfirmation

setValidateRequestDivestitureConfirmation(ValidateRequestDivestitureCo
nfirmation newValidationHandler)
      {
         ValidateRequestDivestitureConfirmation r =
validateRequestDivestitureConfirmation;
         validateRequestDivestitureConfirmation =
newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateRequestFederationRestoreFailed
      getValidateRequestFederationRestoreFailed()
      {
         return validateRequestFederationRestoreFailed;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateRequestFederationRestoreFailed

setValidateRequestFederationRestoreFailed(ValidateRequestFederationRes
toreFailed newValidationHandler)
      {
         ValidateRequestFederationRestoreFailed r =
validateRequestFederationRestoreFailed;
         validateRequestFederationRestoreFailed =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateRequestFederationRestoreSucceeded
      getValidateRequestFederationRestoreSucceeded()
      {
         return validateRequestFederationRestoreSucceeded;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateRequestFederationRestoreSucceeded

setValidateRequestFederationRestoreSucceeded(ValidateRequestFederation
RestoreSucceeded newValidationHandler)
      {
         ValidateRequestFederationRestoreSucceeded r =
validateRequestFederationRestoreSucceeded;
         validateRequestFederationRestoreSucceeded =
newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateRequestRetraction
      getValidateRequestRetraction()
      {
         return validateRequestRetraction;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateRequestRetraction
      setValidateRequestRetraction(ValidateRequestRetraction
newValidationHandler)
      {
         ValidateRequestRetraction r = validateRequestRetraction;
         validateRequestRetraction = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateStartRegistrationForObjectClass
      getValidateStartRegistrationForObjectClass()
      {
         return validateStartRegistrationForObjectClass;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateStartRegistrationForObjectClass

setValidateStartRegistrationForObjectClass(ValidateStartRegistrationFo
rObjectClass newValidationHandler)
      {
         ValidateStartRegistrationForObjectClass r =
validateStartRegistrationForObjectClass;
         validateStartRegistrationForObjectClass =
newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateStopRegistrationForObjectClass
      getValidateStopRegistrationForObjectClass()
      {
         return validateStopRegistrationForObjectClass;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateStopRegistrationForObjectClass

setValidateStopRegistrationForObjectClass(ValidateStopRegistrationForO
bjectClass newValidationHandler)
      {
         ValidateStopRegistrationForObjectClass r =
validateStopRegistrationForObjectClass;
         validateStopRegistrationForObjectClass =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateSynchronizationPointRegistrationFailed
      getValidateSynchronizationPointRegistrationFailed()
      {
         return validateSynchronizationPointRegistrationFailed;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateSynchronizationPointRegistrationFailed

setValidateSynchronizationPointRegistrationFailed(ValidateSynchronizat
ionPointRegistrationFailed newValidationHandler)
      {
         ValidateSynchronizationPointRegistrationFailed r =
validateSynchronizationPointRegistrationFailed;
         validateSynchronizationPointRegistrationFailed =
newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateSynchronizationPointRegistrationSucceeded
      getValidateSynchronizationPointRegistrationSucceeded()
      {
         return validateSynchronizationPointRegistrationSucceeded;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateSynchronizationPointRegistrationSucceeded

setValidateSynchronizationPointRegistrationSucceeded(ValidateSynchroni
zationPointRegistrationSucceeded newValidationHandler)
      {
         ValidateSynchronizationPointRegistrationSucceeded r =
validateSynchronizationPointRegistrationSucceeded;
         validateSynchronizationPointRegistrationSucceeded =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateTimeAdvanceGrant
      getValidateTimeAdvanceGrant()
      {
         return validateTimeAdvanceGrant;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateTimeAdvanceGrant
      setValidateTimeAdvanceGrant(ValidateTimeAdvanceGrant
newValidationHandler)
      {
         ValidateTimeAdvanceGrant r = validateTimeAdvanceGrant;
         validateTimeAdvanceGrant = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateTimeConstrainedEnabled
      getValidateTimeConstrainedEnabled()
      {
         return validateTimeConstrainedEnabled;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateTimeConstrainedEnabled
      setValidateTimeConstrainedEnabled(ValidateTimeConstrainedEnabled
newValidationHandler)
      {
         ValidateTimeConstrainedEnabled r =
validateTimeConstrainedEnabled;
         validateTimeConstrainedEnabled = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateTimeRegulationEnabled
      getValidateTimeRegulationEnabled()
      {
         return validateTimeRegulationEnabled;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateTimeRegulationEnabled
      setValidateTimeRegulationEnabled(ValidateTimeRegulationEnabled
newValidationHandler)
      {
         ValidateTimeRegulationEnabled r =
validateTimeRegulationEnabled;
         validateTimeRegulationEnabled = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateTurnInteractionsOff
      getValidateTurnInteractionsOff()
      {
         return validateTurnInteractionsOff;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateTurnInteractionsOff
      setValidateTurnInteractionsOff(ValidateTurnInteractionsOff
newValidationHandler)
      {
         ValidateTurnInteractionsOff r = validateTurnInteractionsOff;
         validateTurnInteractionsOff = newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateTurnInteractionsOn
      getValidateTurnInteractionsOn()
      {
         return validateTurnInteractionsOn;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateTurnInteractionsOn
      setValidateTurnInteractionsOn(ValidateTurnInteractionsOn
newValidationHandler)
      {
         ValidateTurnInteractionsOn r = validateTurnInteractionsOn;
         validateTurnInteractionsOn = newValidationHandler;
         return r;
      }
      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateTurnUpdatesOffForObjectInstance
      getValidateTurnUpdatesOffForObjectInstance()
      {
         return validateTurnUpdatesOffForObjectInstance;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateTurnUpdatesOffForObjectInstance

setValidateTurnUpdatesOffForObjectInstance(ValidateTurnUpdatesOffForOb
jectInstance newValidationHandler)
      {
         ValidateTurnUpdatesOffForObjectInstance r =
validateTurnUpdatesOffForObjectInstance;
         validateTurnUpdatesOffForObjectInstance =
newValidationHandler;
         return r;
      }

      /**
       * Gets the current Validation handler.
       * @return the current Validation handler
       */
      public ValidateTurnUpdatesOnForObjectInstance
      getValidateTurnUpdatesOnForObjectInstance()
      {
         return validateTurnUpdatesOnForObjectInstance;
      }

      /**
       * Sets the Validation handler to the new value and returns the
previous one.
       * @param newValidationHandler the new Validation handler
       * @return the previous Validation handler
       */
      public ValidateTurnUpdatesOnForObjectInstance

setValidateTurnUpdatesOnForObjectInstance(ValidateTurnUpdatesOnForObje
ctInstance newValidationHandler)
      {
         ValidateTurnUpdatesOnForObjectInstance r =
validateTurnUpdatesOnForObjectInstance;
         validateTurnUpdatesOnForObjectInstance =
newValidationHandler;
         return r;
      }
      /**
       * ############################
       * FederateAmbassador interface
       * ############################
       */
      public void
      synchronizationPointRegistrationSucceeded(
         String synchronizationPointLabel)
      throws FederateInternalError
      {
         if (null!=validateSynchronizationPointRegistrationSucceeded)

validateSynchronizationPointRegistrationSucceeded.validate(
            synchronizationPointLabel);

postEvent(evHLAsynchronizationPointRegistrationSucceeded.create(
            _identifier,
            synchronizationPointLabel)
         );
      } //synchronizationPointRegistrationSucceeded

      public void
      synchronizationPointRegistrationFailed(
         String                            synchronizationPointLabel,
         SynchronizationPointFailureReason reason)
      throws FederateInternalError
      {
         if (null!=validateSynchronizationPointRegistrationFailed)
            validateSynchronizationPointRegistrationFailed.validate(
            synchronizationPointLabel,
            reason);
         postEvent(evHLAsynchronizationPointRegistrationFailed.create(
            _identifier,
            synchronizationPointLabel,
            reason)
         );
      } //synchronizationPointRegistrationFailed

      public void
      announceSynchronizationPoint(
         String synchronizationPointLabel,
         byte[] userSuppliedTag)
      throws FederateInternalError
      {
         if (null!=validateAnnounceSynchronizationPoint)
            validateAnnounceSynchronizationPoint.validate(
            synchronizationPointLabel,
            userSuppliedTag);
         postEvent(evHLAannounceSynchronizationPoint.create(
            _identifier,
            synchronizationPointLabel,
            userSuppliedTag)
         );
      } //announceSynchronizationPoint
```

```
public void
federationSynchronized(
   String synchronizationPointLabel)
throws FederateInternalError
{
   if (null!=validateFederationSynchronized)
      validateFederationSynchronized.validate(
      synchronizationPointLabel);
   postEvent(evHLAfederationSynchronized.create(
      _identifier,
      synchronizationPointLabel)
   );
} //federationSynchronized

public void
initiateFederateSave(
   String label)
throws UnableToPerformSave,
       FederateInternalError
{
   if (null!=validateInitiateFederateSave)
      validateInitiateFederateSave.validate(
      label);
   postEvent(evHLAinitiateFederateSave.create(
      _identifier,
      label,
      null)
   );
} //initiateFederateSave

public void
initiateFederateSave(
   String      label,
   LogicalTime time)
throws InvalidLogicalTime,
       UnableToPerformSave,
       FederateInternalError
{
   if (null!=validateInitiateFederateSave)
      validateInitiateFederateSave.validate(
      label,
      time);
   postEvent(evHLAinitiateFederateSave.create(
      _identifier,
      label,
      time)
   );
} //initiateFederateSave
```

```
public void
federationSaved()
throws FederateInternalError
{
   if (null!=validateFederationSaved)
      validateFederationSaved.validate();
   postEvent(evHLAfederationSaved.create(
      _identifier)
   );
} //federationSaved

public void
federationNotSaved(
   SaveFailureReason reason)
throws FederateInternalError
{
   if (null!=validateFederationNotSaved)
      validateFederationNotSaved.validate(
      reason);
   postEvent(evHLAfederationNotSaved.create(
      _identifier,
      reason)
   );
} //federationNotSaved

public void
federationSaveStatusResponse(
   FederateHandleSaveStatusPair[] response)
throws FederateInternalError
{
   if (null!=validateFederationSaveStatusResponse)
      validateFederationSaveStatusResponse.validate(
      response);
   postEvent(evHLAfederationSaveStatusResponse.create(
      _identifier,
      response)
   );
} //federationSaveStatusResponse

public void
requestFederationRestoreSucceeded(
   String label)
throws FederateInternalError
{
   if (null!=validateRequestFederationRestoreSucceeded)
      validateRequestFederationRestoreSucceeded.validate(
      label);
   postEvent(evHLArequestFederationRestoreSucceeded.create(
      _identifier,
      label)
   );
} //requestFederationRestoreSucceeded
```

```
public void
requestFederationRestoreFailed(
   String label)
throws FederateInternalError
{
   if (null!=validateRequestFederationRestoreFailed)
      validateRequestFederationRestoreFailed.validate(
      label);
   postEvent(evHLArequestFederationRestoreFailed.create(
      _identifier,
      label)
   );
} //requestFederationRestoreFailed

public void
federationRestoreBegun()
throws FederateInternalError
{
   if (null!=validateFederationRestoreBegun)
      validateFederationRestoreBegun.validate();
   postEvent(evHLAfederationRestoreBegun.create(
      _identifier)
   );
} //federationRestoreBegun

public void
initiateFederateRestore(
   String         label,
   FederateHandle federateHandle)
throws SpecifiedSaveLabelDoesNotExist,
          CouldNotInitiateRestore,
          FederateInternalError
{
   if (null!=validateInitiateFederateRestore)
      validateInitiateFederateRestore.validate(
      label,
      federateHandle);
   postEvent(evHLAinitiateFederateRestore.create(
      _identifier,
      label,
      federateHandle)
   );
} //initiateFederateRestore

public void
federationRestored()
throws FederateInternalError
{
   if (null!=validateFederationRestored)
      validateFederationRestored.validate();
   postEvent(evHLAfederationRestored.create(
      _identifier)
   );
} //federationRestored
```

```
public void
federationNotRestored(
   RestoreFailureReason reason)
throws FederateInternalError
{
   if (null!=validateFederationNotRestored)
      validateFederationNotRestored.validate(
      reason);
   postEvent(evHLAfederationNotRestored.create(
      _identifier,
      reason)
   );
} //federationNotRestored

public void
federationRestoreStatusResponse(
   FederateHandleRestoreStatusPair[] response)
throws FederateInternalError
{
   if (null!=validateFederationRestoreStatusResponse)
      validateFederationRestoreStatusResponse.validate(
      response);
   postEvent(evHLAfederationRestoreStatusResponse.create(
      _identifier,
      response)
   );
} //federationRestoreStatusResponse

public void
startRegistrationForObjectClass(
   ObjectClassHandle theClass)
throws ObjectClassNotPublished,
       FederateInternalError
{
   if (null!=validateStartRegistrationForObjectClass)
      validateStartRegistrationForObjectClass.validate(
      theClass);
   postEvent(evHLAstartRegistrationForObjectClass.create(
      _identifier,
      theClass)
   );
} //startRegistrationForObjectClass

public void
stopRegistrationForObjectClass(
   ObjectClassHandle theClass)
throws ObjectClassNotPublished,
       FederateInternalError
{
   if (null!=validateStopRegistrationForObjectClass)
      validateStopRegistrationForObjectClass.validate(
      theClass);
   postEvent(evHLAstopRegistrationForObjectClass.create(
      _identifier,
      theClass)
   );
} //stopRegistrationForObjectClass
```

```
public void
turnInteractionsOn(
   InteractionClassHandle theHandle)
throws InteractionClassNotPublished,
       FederateInternalError
{
   if (null!=validateTurnInteractionsOn)
      validateTurnInteractionsOn.validate(
      theHandle);
   postEvent(evHLAturnInteractionsOn.create(
      _identifier,
      theHandle)
   );
} //turnInteractionsOn

public void
turnInteractionsOff(
   InteractionClassHandle theHandle)
throws InteractionClassNotPublished,
       FederateInternalError
{
   if (null!=validateTurnInteractionsOff)
      validateTurnInteractionsOff.validate(
      theHandle);
   postEvent(evHLAturnInteractionsOff.create(
      _identifier,
      theHandle)
   );
} //turnInteractionsOff

public void
objectInstanceNameReservationSucceeded(
   String objectName)
throws UnknownName,
       FederateInternalError
{
   if (null!=validateObjectInstanceNameReservationSucceeded)
      validateObjectInstanceNameReservationSucceeded.validate(
      objectName);
   postEvent(evHLAobjectInstanceNameReservationSucceeded.create(
      _identifier,
      objectName)
   );
} //objectInstanceNameReservationSucceeded
```

```
public void
objectInstanceNameReservationFailed(
   String objectName)
throws UnknownName,
       FederateInternalError
{
   if (null!=validateObjectInstanceNameReservationFailed)
      validateObjectInstanceNameReservationFailed.validate(
      objectName);
   postEvent(evHLAobjectInstanceNameReservationFailed.create(
      _identifier,
      objectName)
   );
} //objectInstanceNameReservationFailed

public void
discoverObjectInstance(
   ObjectInstanceHandle theObject,
   ObjectClassHandle    theObjectClass,
   String               objectName)
throws CouldNotDiscover,
       ObjectClassNotRecognized,
       FederateInternalError
{
   if (null!=validateDiscoverObjectInstance)
      validateDiscoverObjectInstance.validate(
      theObject,
      theObjectClass,
      objectName);
   postEvent(evHLAdiscoverObjectInstance.create(
      _identifier,
      theObject,
      theObjectClass,
      objectName)
   );
} //discoverObjectInstance
```

```
public void
reflectAttributeValues(
   ObjectInstanceHandle    theObject,
   AttributeHandleValueMap theAttributes,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotSubscribed,
       FederateInternalError
{
   if (null!=validateReflectAttributeValues)
      validateReflectAttributeValues.validate(
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport);
   postEvent(evHLAreflectAttributeValues.create(
      _identifier,
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      null,
      null,
      null,
      null)
   );
} //reflectAttributeValues
```

```
public void
reflectAttributeValues(
   ObjectInstanceHandle    theObject,
   AttributeHandleValueMap theAttributes,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   RegionHandleSet         sentRegions)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotSubscribed,
       FederateInternalError
{
   if (null!=validateReflectAttributeValues)
      validateReflectAttributeValues.validate(
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      sentRegions);
   postEvent(evHLAreflectAttributeValues.create(
      _identifier,
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      null,
      null,
      null,
      sentRegions)
   );
} //reflectAttributeValues
```

```
public void
reflectAttributeValues(
   ObjectInstanceHandle    theObject,
   AttributeHandleValueMap theAttributes,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotSubscribed,
       FederateInternalError
{
   if (null!=validateReflectAttributeValues)
      validateReflectAttributeValues.validate(
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering);
   postEvent(evHLAreflectAttributeValues.create(
      _identifier,
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      null,
      null)
   );
} //reflectAttributeValues
```

```
public void
reflectAttributeValues(
   ObjectInstanceHandle    theObject,
   AttributeHandleValueMap theAttributes,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering,
   RegionHandleSet         sentRegions)
throws ObjectInstanceNotKnown,
   AttributeNotRecognized,
   AttributeNotSubscribed,
   FederateInternalError
{
   if (null!=validateReflectAttributeValues)
      validateReflectAttributeValues.validate(
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      sentRegions);
   postEvent(evHLAreflectAttributeValues.create(
      _identifier,
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      null,
      sentRegions)
   );
} //reflectAttributeValues
```

```
public void
reflectAttributeValues(
   ObjectInstanceHandle    theObject,
   AttributeHandleValueMap theAttributes,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering,
   MessageRetractionHandle retractionHandle)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotSubscribed,
       InvalidLogicalTime,
       FederateInternalError
{
   if (null!=validateReflectAttributeValues)
      validateReflectAttributeValues.validate(
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      retractionHandle);
   postEvent(evHLAreflectAttributeValues.create(
      _identifier,
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      retractionHandle,
      null)
   );
} //reflectAttributeValues
```

```
public void
reflectAttributeValues(
   ObjectInstanceHandle    theObject,
   AttributeHandleValueMap theAttributes,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering,
   MessageRetractionHandle retractionHandle,
   RegionHandleSet         sentRegions)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotSubscribed,
       InvalidLogicalTime,
       FederateInternalError
{
   if (null!=validateReflectAttributeValues)
      validateReflectAttributeValues.validate(
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      retractionHandle,
      sentRegions);
   postEvent(evHLAreflectAttributeValues.create(
      _identifier,
      theObject,
      theAttributes,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      retractionHandle,
      sentRegions)
   );
} //reflectAttributeValues
```

```
public void
receiveInteraction(
   InteractionClassHandle  interactionClass,
   ParameterHandleValueMap theParameters,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport)
throws InteractionClassNotRecognized,
       InteractionParameterNotRecognized,
       InteractionClassNotSubscribed,
       FederateInternalError
{
   if (null!=validateReceiveInteraction)
      validateReceiveInteraction.validate(
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport);
   postEvent(evHLAreceiveInteraction.create(
      _identifier,
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      null,
      null,
      null,
      null)
   );
} //receiveInteraction
```

```
public void
receiveInteraction(
   InteractionClassHandle  interactionClass,
   ParameterHandleValueMap theParameters,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   RegionHandleSet         sentRegions)
throws InteractionClassNotRecognized,
       InteractionParameterNotRecognized,
       InteractionClassNotSubscribed,
       FederateInternalError
{
   if (null!=validateReceiveInteraction)
      validateReceiveInteraction.validate(
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      sentRegions);
   postEvent(evHLAreceiveInteraction.create(
      _identifier,
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      null,
      null,
      null,
      sentRegions)
   );
} //receiveInteraction
```

```
public void
receiveInteraction(
   InteractionClassHandle  interactionClass,
   ParameterHandleValueMap theParameters,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering)
throws InteractionClassNotRecognized,
       InteractionParameterNotRecognized,
       InteractionClassNotSubscribed,
       FederateInternalError
{
   if (null!=validateReceiveInteraction)
      validateReceiveInteraction.validate(
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering);
   postEvent(evHLAreceiveInteraction.create(
      _identifier,
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      null,
      null)
   );
} //receiveInteraction
```

```
public void
receiveInteraction(
   InteractionClassHandle  interactionClass,
   ParameterHandleValueMap theParameters,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering,
   RegionHandleSet         sentRegions)
throws InteractionClassNotRecognized,
       InteractionParameterNotRecognized,
       InteractionClassNotSubscribed,
       FederateInternalError
{
   if (null!=validateReceiveInteraction)
      validateReceiveInteraction.validate(
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      sentRegions);
   postEvent(evHLAreceiveInteraction.create(
      _identifier,
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      null,
      sentRegions)
   );
} //receiveInteraction
```

```
public void
receiveInteraction(
   InteractionClassHandle  interactionClass,
   ParameterHandleValueMap theParameters,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering,
   MessageRetractionHandle messageRetractionHandle)
throws InteractionClassNotRecognized,
       InteractionParameterNotRecognized,
       InteractionClassNotSubscribed,
       InvalidLogicalTime,
       FederateInternalError
{
   if (null!=validateReceiveInteraction)
      validateReceiveInteraction.validate(
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      messageRetractionHandle);
   postEvent(evHLAreceiveInteraction.create(
      _identifier,
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      messageRetractionHandle,
      null)
   );
} //receiveInteraction
```

```
public void
receiveInteraction(
   InteractionClassHandle  interactionClass,
   ParameterHandleValueMap theParameters,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   TransportationType      theTransport,
   LogicalTime             theTime,
   OrderType               receivedOrdering,
   MessageRetractionHandle messageRetractionHandle,
   RegionHandleSet         sentRegions)
throws InteractionClassNotRecognized,
       InteractionParameterNotRecognized,
       InteractionClassNotSubscribed,
       InvalidLogicalTime,
       FederateInternalError
{
   if (null!=validateReceiveInteraction)
      validateReceiveInteraction.validate(
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      messageRetractionHandle,
      sentRegions);
   postEvent(evHLAreceiveInteraction.create(
      _identifier,
      interactionClass,
      theParameters,
      userSuppliedTag,
      sentOrdering,
      theTransport,
      theTime,
      receivedOrdering,
      messageRetractionHandle,
      sentRegions)
   );
} //receiveInteraction
```

```
public void
removeObjectInstance(
   ObjectInstanceHandle theObject,
   byte[]               userSuppliedTag,
   OrderType            sentOrdering)
throws ObjectInstanceNotKnown,
       FederateInternalError
{
   if (null!=validateRemoveObjectInstance)
      validateRemoveObjectInstance.validate(
      theObject,
      userSuppliedTag,
      sentOrdering);
   postEvent(evHLAremoveObjectInstance.create(
      _identifier,
      theObject,
      userSuppliedTag,
      sentOrdering,
      null,
      null,
      null)
   );
} //removeObjectInstance

public void
removeObjectInstance(
   ObjectInstanceHandle theObject,
   byte[]               userSuppliedTag,
   OrderType            sentOrdering,
   LogicalTime          theTime,
   OrderType            receivedOrdering)
throws ObjectInstanceNotKnown,
       FederateInternalError
{
   if (null!=validateRemoveObjectInstance)
      validateRemoveObjectInstance.validate(
      theObject,
      userSuppliedTag,
      sentOrdering,
      theTime,
      receivedOrdering);
   postEvent(evHLAremoveObjectInstance.create(
      _identifier,
      theObject,
      userSuppliedTag,
      sentOrdering,
      theTime,
      receivedOrdering,
      null)
   );
} //removeObjectInstance
```

```
public void
removeObjectInstance(
   ObjectInstanceHandle    theObject,
   byte[]                  userSuppliedTag,
   OrderType               sentOrdering,
   LogicalTime             theTime,
   OrderType               receivedOrdering,
   MessageRetractionHandle retractionHandle)
throws ObjectInstanceNotKnown,
       InvalidLogicalTime,
       FederateInternalError
{
   if (null!=validateRemoveObjectInstance)
      validateRemoveObjectInstance.validate(
      theObject,
      userSuppliedTag,
      sentOrdering,
      theTime,
      receivedOrdering,
      retractionHandle);
   postEvent(evHLAremoveObjectInstance.create(
      _identifier,
      theObject,
      userSuppliedTag,
      sentOrdering,
      theTime,
      receivedOrdering,
      retractionHandle)
   );
} //removeObjectInstance

public void
attributesInScope(
   ObjectInstanceHandle theObject,
   AttributeHandleSet   theAttributes)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotSubscribed,
       FederateInternalError
{
   if (null!=validateAttributesInScope)
      validateAttributesInScope.validate(
      theObject,
      theAttributes);
   postEvent(evHLAattributesInScope.create(
      _identifier,
      theObject,
      theAttributes)
   );
} //attributesInScope
```

```
public void
attributesOutOfScope(
   ObjectInstanceHandle theObject,
   AttributeHandleSet   theAttributes)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotSubscribed,
       FederateInternalError
{
   if (null!=validateAttributesOutOfScope)
      validateAttributesOutOfScope.validate(
      theObject,
      theAttributes);
   postEvent(evHLAattributesOutOfScope.create(
      _identifier,
      theObject,
      theAttributes)
   );
} //attributesOutOfScope

public void
provideAttributeValueUpdate(
   ObjectInstanceHandle theObject,
   AttributeHandleSet   theAttributes,
   byte[]               userSuppliedTag)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotOwned,
       FederateInternalError
{
   if (null!=validateProvideAttributeValueUpdate)
      validateProvideAttributeValueUpdate.validate(
      theObject,
      theAttributes,
      userSuppliedTag);
   postEvent(evHLAprovideAttributeValueUpdate.create(
      _identifier,
      theObject,
      theAttributes,
      userSuppliedTag)
   );
} //provideAttributeValueUpdate
```

```
public void
turnUpdatesOnForObjectInstance(
   ObjectInstanceHandle theObject,
   AttributeHandleSet   theAttributes)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotOwned,
       FederateInternalError
{
   if (null!=validateTurnUpdatesOnForObjectInstance)
      validateTurnUpdatesOnForObjectInstance.validate(
      theObject,
      theAttributes);
   postEvent(evHLAturnUpdatesOnForObjectInstance.create(
      _identifier,
      theObject,
      theAttributes)
   );
} //turnUpdatesOnForObjectInstance

public void
turnUpdatesOffForObjectInstance(
   ObjectInstanceHandle theObject,
   AttributeHandleSet   theAttributes)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotOwned,
       FederateInternalError
{
   if (null!=validateTurnUpdatesOffForObjectInstance)
      validateTurnUpdatesOffForObjectInstance.validate(
      theObject,
      theAttributes);
   postEvent(evHLAturnUpdatesOffForObjectInstance.create(
      _identifier,
      theObject,
      theAttributes)
   );
} //turnUpdatesOffForObjectInstance
```

```
public void
requestAttributeOwnershipAssumption(
   ObjectInstanceHandle theObject,
   AttributeHandleSet   offeredAttributes,
   byte[]               userSuppliedTag)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeAlreadyOwned,
       AttributeNotPublished,
       FederateInternalError
{
   if (null!=validateRequestAttributeOwnershipAssumption)
      validateRequestAttributeOwnershipAssumption.validate(
      theObject,
      offeredAttributes,
      userSuppliedTag);
   postEvent(evHLArequestAttributeOwnershipAssumption.create(
      _identifier,
      theObject,
      offeredAttributes,
      userSuppliedTag)
   );
} //requestAttributeOwnershipAssumption

public void
requestDivestitureConfirmation(
   ObjectInstanceHandle theObject,
   AttributeHandleSet   offeredAttributes)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       AttributeNotOwned,
       AttributeDivestitureWasNotRequested,
       FederateInternalError
{
   if (null!=validateRequestDivestitureConfirmation)
      validateRequestDivestitureConfirmation.validate(
      theObject,
      offeredAttributes);
   postEvent(evHLArequestDivestitureConfirmation.create(
      _identifier,
      theObject,
      offeredAttributes)
   );
} //requestDivestitureConfirmation
```

```
      public void
      attributeOwnershipAcquisitionNotification(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   securedAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAcquisitionWasNotRequested,
             AttributeAlreadyOwned,
             AttributeNotPublished,
             FederateInternalError
      {
         if (null!=validateAttributeOwnershipAcquisitionNotification)

validateAttributeOwnershipAcquisitionNotification.validate(
            theObject,
            securedAttributes,
            userSuppliedTag);

postEvent(evHLAattributeOwnershipAcquisitionNotification.create(
            _identifier,
            theObject,
            securedAttributes,
            userSuppliedTag)
         );
      } //attributeOwnershipAcquisitionNotification

      public void
      attributeOwnershipUnavailable(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotRequested,
             FederateInternalError
      {
         if (null!=validateAttributeOwnershipUnavailable)
            validateAttributeOwnershipUnavailable.validate(
            theObject,
            theAttributes);
         postEvent(evHLAattributeOwnershipUnavailable.create(
            _identifier,
            theObject,
            theAttributes)
         );
      } //attributeOwnershipUnavailable
      public void
      requestAttributeOwnershipRelease(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   candidateAttributes,
         byte[]               userSuppliedTag)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeNotOwned,
             FederateInternalError
      {
         if (null!=validateRequestAttributeOwnershipRelease)
            validateRequestAttributeOwnershipRelease.validate(
            theObject,
            candidateAttributes,
            userSuppliedTag);
         postEvent(evHLArequestAttributeOwnershipRelease.create(
            _identifier,
            theObject,
            candidateAttributes,
            userSuppliedTag)
         );
      } //requestAttributeOwnershipRelease

      public void
      confirmAttributeOwnershipAcquisitionCancellation(
         ObjectInstanceHandle theObject,
         AttributeHandleSet   theAttributes)
      throws ObjectInstanceNotKnown,
             AttributeNotRecognized,
             AttributeAlreadyOwned,
             AttributeAcquisitionWasNotCanceled,
             FederateInternalError
      {
         if
(null!=validateConfirmAttributeOwnershipAcquisitionCancellation)

validateConfirmAttributeOwnershipAcquisitionCancellation.validate(
            theObject,
            theAttributes);

postEvent(evHLAconfirmAttributeOwnershipAcquisitionCancellation.create
(
            _identifier,
            theObject,
            theAttributes)
         );
      } //confirmAttributeOwnershipAcquisitionCancellation
```

```
public void
informAttributeOwnership(
   ObjectInstanceHandle theObject,
   AttributeHandle      theAttribute,
   FederateHandle       theOwner)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       FederateInternalError
{
   if (null!=validateInformAttributeOwnership)
      validateInformAttributeOwnership.validate(
      theObject,
      theAttribute,
      theOwner);
   postEvent(evHLAinformAttributeOwnership.create(
      _identifier,
      theObject,
      theAttribute,
      theOwner)
   );
} //informAttributeOwnership

public void
attributeIsNotOwned(
   ObjectInstanceHandle theObject,
   AttributeHandle      theAttribute)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       FederateInternalError
{
   if (null!=validateAttributeIsNotOwned)
      validateAttributeIsNotOwned.validate(
      theObject,
      theAttribute);
   postEvent(evHLAattributeIsNotOwned.create(
      _identifier,
      theObject,
      theAttribute)
   );
} //attributeIsNotOwned
```

```
public void
attributeIsOwnedByRTI(
   ObjectInstanceHandle theObject,
   AttributeHandle      theAttribute)
throws ObjectInstanceNotKnown,
       AttributeNotRecognized,
       FederateInternalError
{
   if (null!=validateAttributeIsOwnedByRTI)
      validateAttributeIsOwnedByRTI.validate(
      theObject,
      theAttribute);
   postEvent(evHLAattributeIsOwnedByRTI.create(
      _identifier,
      theObject,
      theAttribute)
   );
} //attributeIsOwnedByRTI

public void
timeRegulationEnabled(
   LogicalTime time)
throws InvalidLogicalTime,
       NoRequestToEnableTimeRegulationWasPending,
       FederateInternalError
{
   if (null!=validateTimeRegulationEnabled)
      validateTimeRegulationEnabled.validate(
      time);
   postEvent(evHLAtimeRegulationEnabled.create(
      _identifier,
      time)
   );
} //timeRegulationEnabled

public void
timeConstrainedEnabled(
   LogicalTime time)
throws InvalidLogicalTime,
       NoRequestToEnableTimeConstrainedWasPending,
       FederateInternalError
{
   if (null!=validateTimeConstrainedEnabled)
      validateTimeConstrainedEnabled.validate(
      time);
   postEvent(evHLAtimeConstrainedEnabled.create(
      _identifier,
      time)
   );
} //timeConstrainedEnabled
```

```
      public void
      timeAdvanceGrant(
         LogicalTime theTime)
      throws InvalidLogicalTime,
             JoinedFederateIsNotInTimeAdvancingState,
             FederateInternalError
      {
         if (null!=validateTimeAdvanceGrant)
            validateTimeAdvanceGrant.validate(
            theTime);
         postEvent(evHLAtimeAdvanceGrant.create(
            _identifier,
            theTime)
         );
      } //timeAdvanceGrant

      public void
      requestRetraction(
         MessageRetractionHandle theHandle)
      throws FederateInternalError
      {
         if (null!=validateRequestRetraction)
            validateRequestRetraction.validate(
            theHandle);
         postEvent(evHLArequestRetraction.create(
            _identifier,
            theHandle)
         );
      } //requestRetraction
   } //HLAfederate
}
//end capHLA1516
```

The blfHLA belief set is a simple hash map used by the event-handling plans to retrieve the HLAfederate instance associated with the callback.

```
// File: blfHLA.bel
package ca.gc.drdc_rddc.hla.rti1516.jack;

/**
Matches the HLAfederate identifiers with their instance references
The complex queries hasKey, getInstance and removeInstance all expect
an identifier String argument.
The first one returns true if a tuple featuring this identifier
exists, false otherwise.
The second one returns the HLAfederate instance matched to the
identifier, null otherwise.
The last one returns true if the tuple was removed, false otherwise.
 */

public beliefset
blfHLA
   extends ClosedWorld
{
   #key field String identifier;
   #value field Object instance;
   #indexed query get(String identifier, Object instance);
   #indexed query get(logical String identifier, Object instance);
   #indexed query get(String identifier, logical Object instance);
   #indexed query get(logical String identifier, logical Object
instance);

   #function query public boolean hasKey(String identifier)
   {
      logical Object $some_instance;
      try
      {
         // Check whether or not there already exists an instance with
that identifier
         return get( identifier, $some_instance ).next();
      } catch (aos.jack.jak.beliefset.BeliefSetException bse) {
         bse.printStackTrace();
      } //try
      return false;
   } //hasKey
   #function query public capHLA1516.HLAfederate getInstance(String 
identifier)
   {
      logical Object $some_instance;
      try
      {
         if (! get( identifier, $some_instance ).next() ) return null;
         return (capHLA1516.HLAfederate)($some_instance.as_object());
      } catch (aos.jack.jak.beliefset.BeliefSetException bse) {
         bse.printStackTrace();
      } //try
      return null;
   } //getInstance

   #function query public boolean removeInstance(String identifier)
   {
      logical Object $some_instance;
      try
      {
         if (get( identifier, $some_instance ).next())
         {
            remove(identifier, $some_instance.as_object());
            return true;
         } //if
      } catch (aos.jack.jak.beliefset.BeliefSetException bse) {
         bse.printStackTrace();
      } //try
      return false;
   } //removeInstance
}
//end blfHLA
```

The 43 `event`s all follow the same pattern: their fields consist of a `String` identifier and the callback's parameters. They have just one constructor each. When a `byte[]` appears in the parameters, it is wrapped in an OMT `HLAopaqueData` to avoid JACK compilation errors.

```
// File: evtHLAannounceSynchronizationPoint.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that a new synchronization
point has been registered.
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */

public event evtHLAannounceSynchronizationPoint extends MessageEvent {
   public String identifier;
   public String synchronizationPointLabel;
   public HLAopaqueData userSuppliedTag;

   #posted as
   create(
      String identifier,
      String synchronizationPointLabel,
      byte[] userSuppliedTag)
   {
      this.identifier = identifier;
      this.synchronizationPointLabel = synchronizationPointLabel;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
   }
}
//end evtHLAannounceSynchronizationPoint
```

```
// File: evtHLAattributeIsNotOwned.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI answers the federate's QueryAttributeOwnership
request.
The specified attribute is unowned.
 */
public event evtHLAattributeIsNotOwned extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandle theAttribute;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   {
      this.identifier   = identifier;
      this.theObject    = theObject;
      this.theAttribute = theAttribute;
   }
}
//end evtHLAattributeIsNotOwned

// File: evtHLAattributeIsOwnedByRTI.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI answers the federate's QueryAttributeOwnership
request.
The specified attribute is owned by the RTI.
 */
public event evtHLAattributeIsOwnedByRTI extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandle theAttribute;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute)
   {
      this.identifier   = identifier;
      this.theObject    = theObject;
      this.theAttribute = theAttribute;
   }
}
//end evtHLAattributeIsOwnedByRTI
```

```
// File: evtHLAattributeOwnershipAcquisitionNotification.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the latter now owns the
specified attribute instances.
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */

public event evtHLAattributeOwnershipAcquisitionNotification extends
MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet securedAttributes;
   public HLAopaqueData userSuppliedTag;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   securedAttributes,
      byte[]               userSuppliedTag)
   {
      this.identifier        = identifier;
      this.theObject         = theObject;
      this.securedAttributes = securedAttributes;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
   }
}
//end evtHLAattributeOwnershipAcquisitionNotification
```

```
// File: evtHLAattributeOwnershipUnavailable.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI informs the federate that the specified attribute
instances are not available for acquisition.
 */

public event evtHLAattributeOwnershipUnavailable extends MessageEvent
{
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet theAttributes;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   {
      this.identifier    = identifier;
      this.theObject     = theObject;
      this.theAttributes = theAttributes;
   }
}
//end evtHLAattributeOwnershipUnavailable

// File: evtHLAattributesInScope.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI advises the federate that the specified attribute
instances are now in scope.
 */

public event evtHLAattributesInScope extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet theAttributes;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   {
      this.identifier    = identifier;
      this.theObject     = theObject;
      this.theAttributes = theAttributes;
   }
}
//end evtHLAattributesInScope
```

```
// File: evtHLAattributesOutOfScope.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI advises the federate that the specified attribute
instances are now out of scope.
 */

public event evtHLAattributesOutOfScope extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet theAttributes;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   {
      this.identifier    = identifier;
      this.theObject     = theObject;
      this.theAttributes = theAttributes;
   }
}
//end evtHLAattributesOutOfScope

// File: evtHLAconfirmAttributeOwnershipAcquisitionCancellation.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI requests that the federate confirm its intent to
cancel the pending acquisition of the specified instance attributes.
 */

public event evtHLAconfirmAttributeOwnershipAcquisitionCancellation
extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet theAttributes;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   {
      this.identifier    = identifier;
      this.theObject     = theObject;
      this.theAttributes = theAttributes;
   }
}
//end evtHLAconfirmAttributeOwnershipAcquisitionCancellation
```

```
// File: evtHLAdiscoverObjectInstance.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the federate discovers a new object instance.
 */

public event evtHLAdiscoverObjectInstance extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public ObjectClassHandle theObjectClass;
   public String objectName;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      ObjectClassHandle    theObjectClass,
      String               objectName)
   {
      this.identifier     = identifier;
      this.theObject      = theObject;
      this.theObjectClass = theObjectClass;
      this.objectName     = objectName;
   }
}
//end evtHLAdiscoverObjectInstance

// File: evtHLAfederationNotRestored.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the federation restore
concluded unsuccessfully.
 */

public event evtHLAfederationNotRestored extends MessageEvent {
   public String identifier;
   public RestoreFailureReason reason;

   #posted as
   create(
      String               identifier,
      RestoreFailureReason reason)
   {
      this.identifier = identifier;
      this.reason     = reason;
   }
}
//end evtHLAfederationNotRestored
```

```
// File: evtHLAfederationNotSaved.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the federation save
concluded unsuccessfully.
 */

public event evtHLAfederationNotSaved extends MessageEvent {
   public String identifier;
   public SaveFailureReason reason;

   #posted as
   create(
      String             identifier,
      SaveFailureReason  reason)
   {
      this.identifier = identifier;
      this.reason     = reason;
   }
}
//end evtHLAfederationNotSaved

// File: evtHLAfederationRestoreBegun.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the federation restore
has begun.
 */

public event evtHLAfederationRestoreBegun extends MessageEvent {
   public String identifier;

   #posted as
   create(
      String identifier)
   {
      this.identifier = identifier;
   }
}
//end evtHLAfederationRestoreBegun
```

```
// File: evtHLAfederationRestored.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the federation restore
concluded successfully.
 */

public event evtHLAfederationRestored extends MessageEvent {
   public String identifier;

   #posted as
   create(
      String identifier)
   {
      this.identifier = identifier;
   }
}
//end evtHLAfederationRestored

// File: evtHLAfederationRestoreStatusResponse.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI responds to the federate's query about the
federation restore status.
 */

public event evtHLAfederationRestoreStatusResponse extends
MessageEvent {
   public String identifier;
   public FederateHandleRestoreStatusPair[] response;

   #posted as
   create(
      String identifier,
      FederateHandleRestoreStatusPair[] response)
   {
      this.identifier = identifier;
      this.response   = response;
   }
}
//end evtHLAfederationRestoreStatusResponse
```

```
// File: evtHLAfederationSaved.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the federation save
concluded successfully.
 */

public event evtHLAfederationSaved extends MessageEvent {
   public String identifier;

   #posted as
   create(
      String identifier)
   {
      this.identifier = identifier;
   }
}
//end evtHLAfederationSaved

// File: evtHLAfederationSaveStatusResponse.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI responds to the federate's query about the
federation save status.
 */

public event evtHLAfederationSaveStatusResponse extends MessageEvent {
   public String identifier;
   public FederateHandleSaveStatusPair[] response;

   #posted as
   create(
      String identifier,
      FederateHandleSaveStatusPair[] response)
   {
      this.identifier = identifier;
      this.response   = response;
   }
}
//end evtHLAfederationSaveStatusResponse
```

```
// File: evtHLAfederationSynchronized.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the specified
synchronization point has been achieved.
 */

public event evtHLAfederationSynchronized extends MessageEvent {
   public String identifier;
   public String synchronizationPointLabel;

   #posted as
   create(
      String identifier,
      String synchronizationPointLabel)
   {
      this.identifier                = identifier;
      this.synchronizationPointLabel = synchronizationPointLabel;
   }
}
//end evtHLAfederationSynchronized


// File: evtHLAinformAttributeOwnership.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI answers the federate's QueryAttributeOwnership
request.
The specified attribute is owned by the specified federate.
 */

public event evtHLAinformAttributeOwnership extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandle theAttribute;
   public FederateHandle theOwner;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandle      theAttribute,
      FederateHandle       theOwner)
   {
      this.identifier   = identifier;
      this.theObject    = theObject;
      this.theAttribute = theAttribute;
      this.theOwner     = theOwner;
   }
}
//end evtHLAinformAttributeOwnership
```

```
// File: evtHLAinitiateFederateRestore.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that it should start
restoring its state.
 */

public event evtHLAinitiateFederateRestore extends MessageEvent {
   public String identifier;
   public String label;
   public FederateHandle federateHandle;

   #posted as
   create(
      String         identifier,
      String         label,
      FederateHandle federateHandle)
   {
      this.identifier = identifier;
      this.label      = label;
      this.federateHandle = federateHandle;
   }
}
//end evtHLAinitiateFederateRestore

// File: evtHLAinitiateFederateSave.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that it should start saving
its state.
If a time is specified, that is the time at which the save should
occur.
 */

public event evtHLAinitiateFederateSave extends MessageEvent {
   public String identifier;
   public String label;
   public LogicalTime time;

   #posted as
   create(
      String      identifier,
      String      label,
      LogicalTime time)
   {
      this.identifier = identifier;
      this.label      = label;
      this.time       = time;
   }
}
//end evtHLAinitiateFederateSave
```

```
// File: evtHLAobjectInstanceNameReservationFailed.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that its name reservation
request failed.
 */
public event evtHLAobjectInstanceNameReservationFailed extends
MessageEvent {
   public String identifier;
   public String objectName;

   #posted as
   create(
      String  identifier,
      String  objectName)
   {
      this.identifier = identifier;
      this.objectName = objectName;
   }
}
//end evtHLAobjectInstanceNameReservationFailed

// File: evtHLAobjectInstanceNameReservationSucceeded.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that its name reservation
request succeeded.
 */
public event evtHLAobjectInstanceNameReservationSucceeded extends
MessageEvent {
   public String identifier;
   public String objectName;

   #posted as
   create(
      String  identifier,
      String  objectName)
   {
      this.identifier = identifier;
      this.objectName = objectName;
   }
}
//end evtHLAobjectInstanceNameReservationSucceeded
```

```
// File: evtHLAprovideAttributeValueUpdate.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when the RTI requests an update of some of an object's
attribute values.
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */
public event evtHLAprovideAttributeValueUpdate extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet theAttributes;
   public HLAopaqueData userSuppliedTag;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes,
      byte[]               userSuppliedTag)
   {
      this.identifier      = identifier;
      this.theObject       = theObject;
      this.theAttributes   = theAttributes;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
   }
}
//end evtHLAprovideAttributeValueUpdate
```

```
// File: evtHLAreceiveInteraction.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when an interaction happens.
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */
public event evtHLAreceiveInteraction extends MessageEvent {
   public String identifier;
   public InteractionClassHandle interactionClass;
   public ParameterHandleValueMap theParameters;
   public HLAopaqueData userSuppliedTag;
   public OrderType sentOrdering;
   public TransportationType theTransport;
   public LogicalTime theTime;
   public OrderType receivedOrdering;
   public MessageRetractionHandle messageRetractionHandle;
   public RegionHandleSet sentRegions;

   #posted as
   create(
      String                  identifier,
      InteractionClassHandle  interactionClass,
      ParameterHandleValueMap theParameters,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle messageRetractionHandle,
      RegionHandleSet         sentRegions)
   {
      this.identifier       = identifier;
      this.interactionClass = interactionClass;
      this.theParameters    = theParameters;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
      this.sentOrdering            = sentOrdering;
      this.theTransport            = theTransport;
      this.theTime                 = theTime;
      this.receivedOrdering        = receivedOrdering;
      this.messageRetractionHandle = messageRetractionHandle;
      this.sentRegions             = sentRegions;
   }
}
//end evtHLAreceiveInteraction
```

```
// File: evtHLAreflectAttributeValues.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when the RTI supplies an update for a subscribed object's
attribute(s).
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */
public event evtHLAreflectAttributeValues extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleValueMap theAttributes;
   public HLAopaqueData userSuppliedTag;
   public OrderType sentOrdering;
   public TransportationType theTransport;
   public LogicalTime theTime;
   public OrderType receivedOrdering;
   public MessageRetractionHandle retractionHandle;
   public RegionHandleSet sentRegions;

   #posted as
   create(
      String                  identifier,
      ObjectInstanceHandle    theObject,
      AttributeHandleValueMap theAttributes,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      TransportationType      theTransport,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle,
      RegionHandleSet         sentRegions)
   {
      this.identifier       = identifier;
      this.theObject        = theObject;
      this.theAttributes    = theAttributes;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
      this.sentOrdering     = sentOrdering;
      this.theTransport     = theTransport;
      this.theTime          = theTime;
      this.receivedOrdering = receivedOrdering;
      this.retractionHandle = retractionHandle;
      this.sentRegions      = sentRegions;
   }
}
//end evtHLAreflectAttributeValues
```

```
// File: evtHLAremoveObjectInstance.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when the RTI informs the federate that an object instance has
been deleted.
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */
public event evtHLAremoveObjectInstance extends MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public HLAopaqueData userSuppliedTag;
   public OrderType sentOrdering;
   public LogicalTime theTime;
   public OrderType receivedOrdering;
   public MessageRetractionHandle retractionHandle;

   #posted as
   create(
      String                  identifier,
      ObjectInstanceHandle    theObject,
      byte[]                  userSuppliedTag,
      OrderType               sentOrdering,
      LogicalTime             theTime,
      OrderType               receivedOrdering,
      MessageRetractionHandle retractionHandle)
   {
      this.identifier        = identifier;
      this.theObject         = theObject;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
      this.sentOrdering      = sentOrdering;
      this.theTime           = theTime;
      this.receivedOrdering  = receivedOrdering;
      this.retractionHandle  = retractionHandle;
   }
}
//end evtHLAremoveObjectInstance
```

```
// File: evtHLArequestAttributeOwnershipAssumption.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when the RTI requests that the federate assume ownership of
some attribute instances.
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */
public event evtHLArequestAttributeOwnershipAssumption extends
MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet offeredAttributes;
   public HLAopaqueData userSuppliedTag;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes,
      byte[]               userSuppliedTag)
   {
      this.identifier        = identifier;
      this.theObject         = theObject;
      this.offeredAttributes = offeredAttributes;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
   }
}
//end evtHLArequestAttributeOwnershipAssumption
```

```
// File: evtHLArequestAttributeOwnershipRelease.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import hla.rti1516.*;

/**
Occurs when the RTI requests that the federate relinquish ownership of
the specified attribute instances.
Note that JACK baulks at byte[] fields, so we use an HLAopaqueData
field to wrap the userSuppliedTag.
 */
public event evtHLArequestAttributeOwnershipRelease extends
MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet candidateAttributes;
   public HLAopaqueData userSuppliedTag;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   candidateAttributes,
      byte[]               userSuppliedTag)
   {
      this.identifier          = identifier;
      this.theObject           = theObject;
      this.candidateAttributes = candidateAttributes;
      try {
         this.userSuppliedTag = new HLAopaqueData(userSuppliedTag);
      } catch (Exception ignored) {} //CouldNotDecode, null
userSuppliedTag
   }
}
//end evtHLArequestAttributeOwnershipRelease
```

```
// File: evtHLArequestDivestitureConfirmation.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI requests that the federate confirm its intent to
divest itself of some attribute instances.
 */
public event evtHLArequestDivestitureConfirmation extends MessageEvent
{
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet offeredAttributes;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   offeredAttributes)
   {
      this.identifier        = identifier;
      this.theObject         = theObject;
      this.offeredAttributes = offeredAttributes;
   }
}
//end evtHLArequestDivestitureConfirmation
```

```
// File: evtHLArequestFederationRestoreFailed.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI reports that the federate's specified federation
restore request completed unsuccessfully.
 */
public event evtHLArequestFederationRestoreFailed extends MessageEvent
{
   public String identifier;
   public String label;

   #posted as
   create(
      String identifier,
      String label)
   {
      this.identifier = identifier;
      this.label      = label;
   }
}
//end evtHLArequestFederationRestoreFailed
```

```
// File: evtHLArequestFederationRestoreSucceeded.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI reports that the federate's specified federation
restore request completed successfully.
 */
public event evtHLArequestFederationRestoreSucceeded extends
MessageEvent {
   public String identifier;
   public String label;

   #posted as
   create(
      String identifier,
      String label)
   {
      this.identifier = identifier;
      this.label      = label;
   }
}
//end evtHLArequestFederationRestoreSucceeded

// File: evtHLArequestRetraction.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that the specified event has
been retracted.
 */
public event evtHLArequestRetraction extends MessageEvent {
   public String identifier;
   public MessageRetractionHandle theHandle;

   #posted as
   create(
      String                  identifier,
      MessageRetractionHandle theHandle)
   {
      this.identifier = identifier;
      this.theHandle  = theHandle;
   }
}
//end evtHLArequestRetraction
```

```
// File: evtHLAstartRegistrationForObjectClass.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that there are active
subscribers for the specified object class.
 */
public event evtHLAstartRegistrationForObjectClass extends
MessageEvent {
   public String identifier;
   public ObjectClassHandle theClass;

   #posted as
   create(
      String            identifier,
      ObjectClassHandle theClass)
   {
      this.identifier = identifier;
      this.theClass   = theClass;
   }
}
//end evtHLAstartRegistrationForObjectClass

// File: evtHLAstopRegistrationForObjectClass.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that there are no active
subscribers for the specified object class.
 */
public event evtHLAstopRegistrationForObjectClass extends MessageEvent
{
   public String identifier;
   public ObjectClassHandle theClass;

   #posted as
   create(
      String            identifier,
      ObjectClassHandle theClass)
   {
      this.identifier = identifier;
      this.theClass   = theClass;
   }
}
//end evtHLAstopRegistrationForObjectClass
```

```
// File: evtHLAsynchronizationPointRegistrationFailed.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI signals that a synchronization point registration
was unsuccessfull.
 */
public event evtHLAsynchronizationPointRegistrationFailed extends
MessageEvent {
   public String identifier;
   public String synchronizationPointLabel;
   public SynchronizationPointFailureReason reason;

   #posted as
   create(
      String                            identifier,
      String                            synchronizationPointLabel,
      SynchronizationPointFailureReason reason)
   {
      this.identifier                = identifier;
      this.synchronizationPointLabel = synchronizationPointLabel;
      this.reason                    = reason;
   }
}
//end evtHLAsynchronizationPointRegistrationFailed

// File: evtHLAsynchronizationPointRegistrationSucceeded.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI signals that a synchronization point registration
was successfull.
 */
public event evtHLAsynchronizationPointRegistrationSucceeded extends
MessageEvent {
   public String identifier;
   public String synchronizationPointLabel;

   #posted as
   create(
      String                            identifier,
      String                            synchronizationPointLabel)
   {
      this.identifier                = identifier;
      this.synchronizationPointLabel = synchronizationPointLabel;
   }
}
//end evtHLAsynchronizationPointRegistrationSucceeded
```

```
// File: evtHLAtimeAdvanceGrant.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that it is has been granted
an advance to the specified time.
 */
public event evtHLAtimeAdvanceGrant extends MessageEvent {
   public String identifier;
   public LogicalTime time;

   #posted as
   create(
      String      identifier,
      LogicalTime time)
   {
      this.identifier = identifier;
      this.time       = time;
   }
}
//end evtHLAtimeAdvanceGrant

// File: evtHLAtimeConstrainedEnabled.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that it is time-constrained
as of the specified time.
 */
public event evtHLAtimeConstrainedEnabled extends MessageEvent {
   public String identifier;
   public LogicalTime time;

   #posted as
   create(
      String      identifier,
      LogicalTime time)
   {
      this.identifier = identifier;
      this.time       = time;
   }
}
//end evtHLAtimeConstrainedEnabled
```

```
// File: evtHLAtimeRegulationEnabled.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that it is time-regulating
as of the specified time.
 */
public event evtHLAtimeRegulationEnabled extends MessageEvent {
   public String identifier;
   public LogicalTime time;

   #posted as
   create(
      String      identifier,
      LogicalTime time)
   {
      this.identifier = identifier;
      this.time       = time;
   }
}
//end evtHLAtimeRegulationEnabled

// File: evtHLAturnInteractionsOff.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that there are no active
subscribers for the specified interaction class.
 */
public event evtHLAturnInteractionsOff extends MessageEvent {
   public String identifier;
   public InteractionClassHandle theHandle;

   #posted as
   create(
      String identifier,
      InteractionClassHandle  theHandle)
   {
      this.identifier = identifier;
      this.theHandle  = theHandle;
   }
}
//end evtHLAturnInteractionsOff
```

```
// File: evtHLAturnInteractionsOn.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that there are active
subscribers for the specified interaction class.
 */
public event evtHLAturnInteractionsOn extends MessageEvent {
   public String identifier;
   public InteractionClassHandle theHandle;

   #posted as
   create(
      String identifier,
      InteractionClassHandle  theHandle)
   {
      this.identifier = identifier;
      this.theHandle  = theHandle;
   }
}
//end evtHLAturnInteractionsOn


// File: evtHLAturnUpdatesOffForObjectInstance.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that there are no active
subscribers for the specified object instance attributes.
 */
public event evtHLAturnUpdatesOffForObjectInstance extends
MessageEvent {
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet theAttributes;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   {
      this.identifier    = identifier;
      this.theObject     = theObject;
      this.theAttributes = theAttributes;
   }
}
//end evtHLAturnUpdatesOffForObjectInstance
```

```
// File: evtHLAturnUpdatesOnForObjectInstance.event
package ca.gc.drdc_rddc.hla.rti1516.jack;

import hla.rti1516.*;

/**
Occurs when the RTI notifies the federate that there are active
subscribers for the specified object instance attributes.
 */
public event evtHLAturnUpdatesOnForObjectInstance extends MessageEvent
{
   public String identifier;
   public ObjectInstanceHandle theObject;
   public AttributeHandleSet theAttributes;

   #posted as
   create(
      String               identifier,
      ObjectInstanceHandle theObject,
      AttributeHandleSet   theAttributes)
   {
      this.identifier    = identifier;
      this.theObject     = theObject;
      this.theAttributes = theAttributes;
   }
}
//end evtHLAturnUpdatesOnForObjectInstance
```

The 43 `plan`s are all built from the same very simple pattern. For this reason, a template is provided below. The only variable is the `<callback_name>` term, which can be any of the corresponding 43 event names.

```
// File: pln<callback_name>.plan
package ca.gc.drdc_rddc.hla.rti1516.jack;

/**
Null handler for the evt<callback_name>.
These plans are only meant to keep the run-time from complaining when
the agent using this capability is instantiated.
 */
public plan
pln<callback_name>
   extends Plan
{
   #handles event evt<callback_name> ev;

   static boolean relevant(evt<callback_name> ev)
   {
      return false;
   }

   context()
   {
       true;
   }

   #reasoning method
   body()
   {
   }
}
//end pln<callback_name>
```

Part Two – The JACK Chat Client Proper

```
// File: HLAchat.prj
"ProjectName" node:  HLAchat
  "Introduction" node
    (textual description of the chat client)
"Design Views" node
  "Design Views (Federation Architecture)" node
    "Overview_ChatRoomSlots" node
      (explanatory diagram and "Documentation" node)
    "Overview_Interactions" node
      (explanatory diagram and "Documentation" node)
    "Overview_Objects" node
      (explanatory diagram and "Documentation" node)
    "Overview_UserHandleSlots" node
      (explanatory diagram and "Documentation" node)
  "Design Views (Application Architecture)" node
    "Application_Overview" node
      (explanatory diagram and "Documentation" node)
    "Data_Control" node
      (explanatory diagram and "Documentation" node)
    ("Group_Who" diagram and "Documentation" node)
    ("Joining_Group" diagram and "Documentation" node)
    ("Leaving_Group" diagram and "Documentation" node)
    ("Listing_Groups" diagram and "Documentation" node)
    ("Logging_Out" diagram and "Documentation" node)
    ("Logging_In" diagram and "Documentation" node)
    ("ProcessChat" diagram and "Documentation" node)
    ("ProcessData" diagram and "Documentation" node)
    ("Sending_Message_Group" diagram and "Documentation" node)
    ("Sending_Message_User" diagram and "Documentation" node)
    ("StartClient" diagram and "Documentation" node)
    ("StartServer" diagram and "Documentation" node)
"Agent Model" node
  "Agent Types" node
    "Client"
    "Server"
  "Capability Types" node
    "capHLA1516"
    "capProcessChat"
    "capProcessData"
  "Plan Types" node
    "Plan Types - Client" node
      "plnProcessGrpNames"
      "plnProcessGrpWhoRes"
      "plnProcessJoinRes"
      "plnProcessLeaveGrpRes"
      "plnProcessLoginRes"
      "plnProcessMessageUsrRes"
      "plnProcessNoGrp"
      "plnProcessRelayMessg"
```

```
"Plan Types - HLA" node
  "ChatRoom" node
    "plnHLA_ChatRoom_Discovery"
    "plnHLA_ChatRoom_OwnershipAcquisitionFailed"
    "plnHLA_ChatRoom_OwnershipAcquisitionNotification"
    "plnHLA_ChatRoom_OwnershipAssumptionRequest"
    "plnHLA_ChatRoom_OwnershipDivestitureConfirmationRequest"
    "plnHLA_ChatRoom_OwnershipReleaseRequest"
    "plnHLA_ChatRoom_ProvideAttributeValueUpdate"
    "plnHLA_ChatRoom_ReflectAttributeValueUpdate"
    "plnHLA_ChatRoom_Removal"
    "plnHLA_WaitingRoom_NameReservation_Failed"
    "plnHLA_WaitingRoom_NameReservation_Succeeded"
  "ChatRoomRegistry" node
    "plnHLA_AcquireChatRoomRegistry"
    "plnHLA_ChatRoomRegistry_Discovery"
    "plnHLA_ChatRoomRegistry_NameReservation_Failed"
    "plnHLA_ChatRoomRegistry_NameReservation_Succeeded"
    "plnHLA_ChatRoomRegistry_OwnershipAcquisitionFailed"
    "plnHLA_ChatRoomRegistry_OwnershipAcquisitionNotification"
    "plnHLA_ChatRoomRegistry_OwnershipAssumptionRequest"
    "plnHLA_ChatRoomRegistry_OwnershipDivestitureConfirmationRequest"
    "plnHLA_ChatRoomRegistry_OwnershipReleaseRequest"
    "plnHLA_ChatRoomRegistry_ProvideAttributeValueUpdate"
    "plnHLA_ChatRoomRegistry_ReflectAttributeValueUpdate"
  "Interaction" node
    "plnHLA_Interaction"
    "plnHLA_InteractionScopeAdvisory_Off"
    "plnHLA_InteractionScopeAdvisory_On"
  "Participant" node
    "plnHLA_Participant_AttributeScopeAdvisory_In"
    "plnHLA_Participant_AttributeScopeAdvisory_Out"
    "plnHLA_Participant_Discovery"
    "plnHLA_Participant_NameReservation_Failed"
    "plnHLA_Participant_NameReservation_Succeeded"
    "plnHLA_Participant_OwnershipAcquisitionFailed"
    "plnHLA_Participant_OwnershipAcquisitionNotification"
    "plnHLA_Participant_OwnershipAssumptionRequest"
    "plnHLA_Participant_OwnershipDivestitureConfirmationRequest"
    "plnHLA_Participant_OwnershipReleaseRequest"
    "plnHLA_Participant_ProvideAttributeValueUpdate"
    "plnHLA_Participant_ReflectAttributeValueUpdate"
    "plnHLA_ParticipantEntersGeneralChatRoom"
  "plnHLA_ForceDivest"
"Plan Types - Server" node
  "plnJoinGrp"
  "plnLeaveGrp"
  "plnListGrp"
  "plnLoginUser"
  "plnLogoutUsr"
  "plnMessageGrp"
  "plnMessageUsr"
  "plnRequestGrpWho"
"from [ca.gc.drdc_rddc.hla.rti1516.jack]" node
  ("pln<callback_name>" plans)
  "Event Types" node
    "Event Types - Client" node
      "evtJoinGrp"
      "evtLeaveGrp"
      "evtListGrp"
      "evtLogout"
      "evtMessageGrp"
      "evtMessageUsr"
      "evtRequestGrpWho"
      "evtUserLogin"
    "Event Types - HLA" node
      "evtHLA_AcquireChatRoomRegistry"
      "evtHLA_ForceDivest"
      "evtHLA_ParticipantEntersGeneralChatRoom"
    "Event Types - Server" node
      "evtGrpName"
      "evtGrpWhoRes"
      "evtJoinRes"
      "evtLeaveGrpRes"
      "evtLoginRes"
      "evtMessageUsrRes"
      "evtNoGrp"
      "evtRelayMessg"
    "from [ca.gc.drdc_rddc.hla.rti1516.jack]" node
      ("evt<callback_name>" events)
  "Named Data" node
    "blfHLA datHLA"
    "blfUsers blfdatUsers"
    "viewKeyboard vewdatKeyboard"
"Data Model" node
  "Beliefset Types" node
    "blfUsers"
    "from [ca.gc.drdc_rddc.hla.rti1516.jack]" node
      "blfHLA"
  "View Types" node
    "viewKeyboard"
  "External Classes" node
    (empty)
"Other Files" node
  "server\MyObservable.java"
  "StartClient.java"
  "StartServer.java"
//end HLAchat
```

The StartClient class is used to bootstrap the JACK Chat client. It is invoked simply by “java StartClient [<server_host>] <server_port>”, where <server_host> defaults to "localhost". It connects the client to the server and then processes a minimal set of commands (quit/exit or login) until a login is successful, at which point the Client agent takes over.

```
// File: StartClient.java
import aos.jack.jak.core.Dci;
import aos.jack.jak.core.DciException;
import aos.dci.Portal;
import aos.jack.Kernel;

import java.io.*;
import java.util.StringTokenizer;
import java.lang.Thread; // for yield()
import java.net.InetAddress; // for getting the host address
import java.net.UnknownHostException;
import java.util.Random;

import client.*;

public class StartClient
{
   static BufferedReader buf;
// static final int MAX_USER_PER_IP = 1000;

   public static void main(String[] args)
   {
      String host, port;

      args = Kernel.init(args);
      if ((args.length < 1) || (args.length > 2))
      {
         System.err.println("Chat client usage: [<server_host>]
<server_port>");
         System.exit(0);
      }

      System.out.println("Starting chat client...");
      System.out.println("Identifying local host...");
      if ( args.length == 1 )
      {  host = "localhost"; port = args[0]; }
      else
      {  host = args[0];     port = args[1]; }

      //Note that we can't create name inside the try block
      //(it becomes local to it) and that we must initialise it
      //to satisfy the compiler (which is worried we may escape
      //from the try/catch without setting 'name')
      String name = "";
      try
      {
         /* Get the IP address of this machine and
            create a unique portal name for this process.

            The original code drew a random number for its portal
            and hoped for the best:

         name = (new Random()).nextInt(MAX_USER_PER_IP) + ":" +
                (InetAddress.getLocalHost()).getHostAddress();

            Here we use the System.currentTimeMillis() to improve our
chances.
            I guess we could also use the hashCode() of a throwaway
object.
          */
         name = System.currentTimeMillis() + ":" +
                (InetAddress.getLocalHost()).getHostAddress();
      } catch (UnknownHostException uhe) {
         System.err.println(uhe);
         System.err.println("Unable to retrieve the host.
Exiting...");
         System.exit(0);
      }
      System.out.println("Local host identified.");

      System.out.println("Looking up chat server...");
      try
      {
         /* Create a portal for this process with the name being the
          * local host address with a pseudo-random number prefixed
          * (see above).
          * Since we have not provided a specific port number for the
          * local portal, we will be given a random free port.
          */
         Dci.create(name, "");
         System.out.println("Local Portal created as \"" + name +
"\"");
         System.out.println("Local Portal host is " + Dci.getHost());
         System.out.println("Local Portal port is " + Dci.getPort());

         /* Connect to the nameserver */
         String rdesc = (host + ":" + port);
         Dci.nameserver(rdesc);
         System.out.println("Nameserver address is \"" + rdesc +
"\"");
```

```
         // Try to ping the server agent. This will try a few times.
         if (Dci.multiPingOk("ChatServer@ServerPortal"))
         {
            System.out.println("Found Server agent
ChatServer@ServerPortal");
            startChat();
         } else {
            System.err.println("Chat Server agent doesn't exist!");
         }
      } catch (DciException de) {
         System.err.println("DCI Exception caught!");
         System.err.println(de);
//       System.exit(0);
      }
   }

   public static void startChat()
   {
      buf = new BufferedReader(new InputStreamReader(System.in));

      try
      {
         System.out.println("\n\n***************************");
         System.out.println(    "*                         *");
         System.out.println(    "* WELCOME TO \"AGENT-CHAT\" *");
         System.out.println(    "*                         *");
         System.out.println(    "***************************\n\n");

         String line = "";
         //This'll loop until a Quit/Exit or a successfull login
         do
         {
            System.err.print("ChatServer@ServerPortal: ");
            line = buf.readLine();   // read in commands.
         }
         while (!processLine(line));
         //Once out of this, the ProcessLogRes Plan will generate
Events
      }
      catch (IOException ioe)
      {
         System.err.println(ioe);
      }
   }
   public static boolean processLine(String line)
   {
      StringTokenizer tokenizer = new StringTokenizer(line, " ");
      //blank command line?
      if ( !tokenizer.hasMoreTokens() ) return false;
      int numTokens = tokenizer.countTokens();
      String command = tokenizer.nextToken();

      if ( (command.equals("quit")) || (command.equals("exit")) )
      {
         //'Quit'/'Exit' command
         System.out.println("\nExiting...");
         System.exit(0);
         return true; //to satisfy the compiler
      }
      else if ( command.equals("login") && (numTokens == 2) )
      {
         //'Login <username>' command
         String username = tokenizer.nextToken();
         System.out.println("Creating Client '" + username + "'");
         //Try launching a Client agent
         Client user = new Client(username);
         //The original code launched the login process like this:
//       user.send("ChatServer@ServerPortal", ((new
UserLogin()).login(username)) );
         //That line now appears in the Client's constructor

         //Wait for the login request to be processed
         do
         {
            Thread.yield();
         }
         while ( user.getLoginPendingStatus() );

         //Now it's safe to check the login status
         if (user.getLogStatus() == false)
         {
            System.out.println("Login failed.");
            return false;
         } else {
            //Login successful; exit the StartClient command loop
            System.out.println("Login successfull.");
            return true;
         }
      } else {
         //Unrecognised command
         System.out.println("***Use either 'login <username>', 'quit'
or 'exit'");
         return false;
      }
   }
}
//end StartClient
```

The `StartServer` class is used to launch the JACK Chat server. It is invoked simply by "`java StartServer [<server_port>]`", where `<server_port>` defaults to "`5000`". It sets up the JACK networking required for Client-Server connections and serves to report Server activity.

```
// File: StartServer.java
import aos.jack.jak.core.Dci;
import aos.jack.jak.core.DciException;
import aos.jack.Kernel;

import java.io.*;

import server.*;

public class StartServer
{
   static BufferedReader buf;

   public static void main(String[] args)
   {
      args = Kernel.init(args);

      String port;
      String[] HLAargs; //Will be passed to HLAmyChat
      //HLAargs is args.subarray(1);
      if (args.length >= 1)
      {
         port = args[0];   // grab port number from extra args
         //Oddly, there is no Array (or java.util) method
         //to extract a sub-array (like String.substring)
         HLAargs = new String[args.length - 1];
         for (int i = 1; i < args.length; i++) HLAargs[i - 1] =
args[i];
      } else {
         port = "5000";   // use default port number
         HLAargs = new String[0]; //Not the same as null!
      }
      try
      {
         Dci.nameserver(port);   // create a nameserver
         System.out.println("New 'nameserver' created.");

         //Dci.create may throw aos.jack.jak.core.DciException
         //but there is no known recovery method; the Dci service
         //is left in a bad state and we cannot just try creating
         //on a different port.
         try
         {
            Dci.create("ServerPortal", port);   // create a new portal
for the server agent
         } catch (aos.jack.jak.core.DciException de) {
            System.err.println("+++ ServerPortal could not be created
+++");
            System.err.println("+++ Try again with a different port
+++");
            System.exit(0);
         }
         System.out.println("ServerPortal created.");
         System.out.println("Server Host: " + Dci.getHost());
         System.out.println("Server Port: " + Dci.getPort());

         Server server = new Server("ChatServer", HLAargs);   //
create server agent
         System.out.println("Server agent '" + server.name() + "'
created.");
         System.out.println("+++ Server startup concluded +++");

         //The original code did not need any finalizer, so it just
waited for the app to be interrupted:
//       System.out.println("Hit Ctrl-C to terminate.");
         //We cannot afford that, so we do this instead:
         try
         {
            //When run from the Compiler Utility, the JDE owns
System.in, so this does not work
            System.err.print("\nHit any key to terminate:\n");
            buf = new BufferedReader(new
InputStreamReader(System.in));
            String line = buf.readLine();   // read in any key
         }
         catch (IOException ioe)
         {
            System.err.println(ioe);
         }
         //Shut down cleanly
         //LogoutUsr plan will do this:
//       HLAchat.finalize();
         //Essentially, we need to post a LogoutAllUsersIGE
         //whose plan, like MsgGrpPlan, retrieves all Client users
         //and posts a Logout event for each.

         System.out.println("+++ Server shut down +++");
         System.exit(0);
      } catch (DciException de) {
         System.err.println("DCI Exception caught!");
         System.err.println(de);
         System.exit(0);
      }
   }
}
//end StartServer
```

The `Client.agent` was only modified from the AOS-supplied demonstration to the extent of fixing one broken line (the demonstration apparently predates version 4) and changing most identifiers to make them more intelligible. The line that sends the UserLogin event was also moved from `StartClient` to the `Client` constructor.

```
// File: Client.agent
package client;

import java.io.*;
import server.evtGrpName;
import server.evtLeaveGrpRes;
import server.evtJoinRes;
import server.evtNoGrp;
import server.evtGrpWhoRes;
import server.evtMessageUsrRes;
import server.evtRelayMessg;
import server.evtLoginRes;

/**
The Client agent represents a single user within the chat network.
 */
public agent
Client
   extends Agent
{
   #has capability capProcessChat cap;
   #handles event evtGrpName;
   #handles event evtGrpWhoRes;
   #handles event evtJoinRes;
   #handles event evtLeaveGrpRes;
   #handles event evtLoginRes;
   #handles event evtMessageUsrRes;
   #handles event evtNoGrp;
   #handles event evtRelayMessg;
   #sends event evtJoinGrp evJoinGrp;
   #sends event evtLeaveGrp evLeaveGrp;
   #sends event evtListGrp evListGrp;
   #sends event evtLogout evLogout;
   #sends event evtMessageGrp evMessageGrp;
   #sends event evtMessageUsr evMessageUsr;
   #sends event evtRequestGrpWho evRequestGrpWho;
   #sends event evtUserLogin evUserLogin;
   #uses plan plnProcessGrpNames;
   #uses plan plnProcessGrpWhoRes;
   #uses plan plnProcessJoinRes;
   #uses plan plnProcessLeaveGrpRes;
   #uses plan plnProcessLoginRes;
   #uses plan plnProcessMessageUsrRes;
   #uses plan plnProcessNoGrp;
   #uses plan plnProcessRelayMessg;
   #private data viewKeyboard vewdatKeyboard();
   //Final result of login request
   private boolean logged = false;
   //True while a login request is pending
   private boolean login_pending = false;
   //Current group to which the client belongs
   private String group;
   //Login name of the user
   private String name;

   public Client(String name)
   {
     super(name);
     //Initiate login request
     setLoginPendingStatus(true);
     send("ChatServer@ServerPortal", evUserLogin.login(name));
   }

   public boolean getLoginPendingStatus()
   {
      return login_pending;
   }

   public boolean getLogStatus()
   {
      return logged;
   }

   String getGroup()
   {
      return group;
   }

   String getUserName()
   {
      //Was getName() but this now conflicts with an inherited final
(?) method
      return name;
   }

   void setGroup(String group)
   {
      this.group = group;
   }

   public void setLoginPendingStatus(boolean status)
   {
      login_pending = status;
   }

   public void setLogStatus(boolean status)
   {
      logged = status;
   }
   void setName(String name)
   {
      this.name = name;
   }
}
//end Client
```

The `capProcessChat` capability simply regroups a subset of the client events: it handles the result of the login request and manages the client command-line parsing. It is not clear why AOS chose to put just the `client`-packaged events (except for `evtUserLogin`) in this capability.

```
// File: capProcessChat.cap
package client;

import server.evtLoginRes;

/**
This capability implements the processing of the Client agent's chat
session commands.
 */
public capability capProcessChat extends Capability {
    #handles external event evtLoginRes;
    #sends event evtJoinGrp ev;
    #sends event evtLeaveGrp ev1;
    #sends event evtListGrp ev5;
    #sends event evtLogout ev6;
    #sends event evtMessageGrp ev4;
    #sends event evtMessageUsr ev2;
    #sends event evtRequestGrpWho ev3;
    #uses plan plnProcessLoginRes;
    #imports data viewKeyboard vewdatKeyboard();
}
//end capProcessChat
```

The `viewKeyboard` view wraps the keyboard primitives, turning command-line input into events sent to the Server. The `EventSource` interface mentioned here is not documented at all by AOS.

```
// File: viewKeyboard.view
package client;

import java.util.StringTokenizer;
import aos.jack.jak.agent.Agent;

/**
This view wraps some keyboard primitives.
 */
public view
viewKeyboard
   implements EventSource
{
   EventRecipient self;
   evtJoinGrp joinGrpEv;
   evtLeaveGrp leaveGrpEv;
   evtListGrp listGrpEv;
   evtMessageGrp msgGrpEv;
   evtMessageUsr msgUsrEv;
   evtRequestGrpWho grpWhoEv;

   public boolean attach(EventRecipient er)
   {
      self = er;
      joinGrpEv = (evtJoinGrp) er.findEvent(
evtJoinGrp.class.getName() );
      leaveGrpEv = (evtLeaveGrp) er.findEvent(
evtLeaveGrp.class.getName() );
      grpWhoEv = (evtRequestGrpWho) er.findEvent(
evtRequestGrpWho.class.getName() );
      msgGrpEv = (evtMessageGrp) er.findEvent(
evtMessageGrp.class.getName() );
      msgUsrEv = (evtMessageUsr) er.findEvent(
evtMessageUsr.class.getName() );
      listGrpEv = (evtListGrp) er.findEvent(
evtListGrp.class.getName() );
     return true;
   }
   public MessageEvent processLine(String line)
   {
      StringTokenizer tokenizer = new StringTokenizer(line, " ");
      String cmd = "";
      if ( tokenizer.hasMoreTokens() ) cmd = tokenizer.nextToken();
      if ( cmd.equals("join") )
      {
         if ( tokenizer.hasMoreTokens() )
         {
            String group = tokenizer.nextToken();
            System.out.println("***Now joining group: " + group);
            return joinGrpEv.join(group, ((Client)
self).getUserName());
         } else {
            System.err.println("***ERROR: Specify the group to join");
         }
      }
      else if ( cmd.equals("leave") )
      {
         if ( tokenizer.hasMoreTokens() )
         {
            String group = tokenizer.nextToken();
            System.out.println("***Now leaving group: " + group);
            return leaveGrpEv.leave( group, ((Client)
self).getUserName() );
         } else {
            System.err.println("***ERROR: Specify the group to
leave");
         }
      }
      else if ( cmd.equals("who") )
      {
         if ( tokenizer.hasMoreTokens() )   // 'who group_name'
         {
            String group = tokenizer.nextToken();
            return grpWhoEv.grpWho( group );
         } else {
            // 'who'
            return grpWhoEv.grpWho( ((Client) self).getGroup() );
         }
      }
      else if ( cmd.equals("msg") )
      {
         String mesg = "";
         while ( tokenizer.hasMoreTokens() )
         {
            mesg += tokenizer.nextToken() + " ";
         }
         System.out.println( "***Message was sent to the '" +
((Client) self).getGroup() + "' group.");
         return msgGrpEv.msgGrp( mesg, ((Client) self).getGroup(),
((Client) self).getUserName() );
      }
      else if ( cmd.equals("msgusr") )
      {
         if ( tokenizer.hasMoreTokens() )
         {
            String user = tokenizer.nextToken();
            String mesg = "";
            // read in the message
            while ( tokenizer.hasMoreTokens() )
            {
               mesg += tokenizer.nextToken() + " ";
            }
            // send message to user
            return msgUsrEv.message(mesg, user, ((Client)
self).getUserName() );
         } else {
            System.err.println("***ERROR: Specify the destination
username");
         }
      }
      else if ( cmd.equals("group") )
      {
         return listGrpEv.list();
      }
      else if ( cmd.equals("help") )
      {
         System.out.println("\nCOMMANDS:");
         System.out.println("========");
         System.out.println("\nmsg <message_text> \t Send a message to
everyone in the current group.");
         System.out.println("\nmsgusr <username> <message_text> \t
Send a message to the user 'username'.");
         System.out.println("\nwho \t\t\t Lists all users in the
current group.");
         System.out.println("\nwho <group_name> \t Lists all users in
the group 'group_name'.");
         System.out.println("\njoin <group_name> \t Join the group
'group_name'.");
         System.out.println("\nleave <group_name> \t Leave the group
'group_name' (Get removed from it)." );
         System.out.println("\ngroup \t\t\t Lists all the groups that
exist." );
         System.out.println("\nlogout \t\t\t Logout (Exit program).\n"
);
      }
      else if ( cmd.equals("") )
      {
         // nothing entered. Do nothing.
         return null;
      } else {
         System.err.println("\n***ERROR: Unrecognised command. Type
'help' for a list of commands.");
         return null;
      }
      return null;
   }
}
//end viewKeyboard
```

The `evtUserLogin` event represents a login request. The `user` is the requested user name.

```
// File: evtUserLogin.event
package client;

/**
This event is sent by the Client to the Server, to request a login.
 */
public event
evtUserLogin
   extends MessageEvent
{
   public String username;

   #posted as
   login(String user)
   {
      username = user;
   }
}
//end evtUserLogin
```

The `evtLoginRes` event represents the outcome of the login request. The `status` indicates whether it was successful or not, `user` is the requested username and `location` the network-name of the originating JACK agent.

```
// File: evtLoginRes.event
package server;

/**
This event is an envelope for the data that is sent back to the client
From the server, as a result of the login procedure.
 */
public event
evtLoginRes
   extends MessageEvent
{
   public boolean status;
   public String location;
   public String user;

   #posted as
   result(String username, String location, boolean logStatus)
   {
      user = username;
      this.location = location;
      status = logStatus;
   }
}
//end evtLoginRes
```

The plnProcessLoginRes plan processes the outcome of the login request. If a failure, it shuts down the agent, and control returns to the StartClient command-line loop. Otherwise, it starts prompting viewKeyboard to parse the user commands.

```
// File: plnProcessLoginRes.plan
package client;

import java.io.*;
import java.util.StringTokenizer;
import server.*;
import server.evtLoginRes;

/**
This plan processes the outcome of the login request;
if successfull, it initiates the processing of the Client agent's chat
commands.
 */
public plan
plnProcessLoginRes
   extends Plan
{
   public static BufferedReader
   buf = new BufferedReader( new InputStreamReader( System.in ) );
   #handles event evtLoginRes logResEv;
   #sends event evtJoinGrp joinGrpEv;
   #sends event evtLeaveGrp leaveGrpEv;
   #sends event evtListGrp listGrpEv;
   #sends event evtLogout logoutEv;
   #sends event evtMessageGrp msgGrpEv;
   #sends event evtMessageUsr msgUsrEv;
   #sends event evtRequestGrpWho grpWhoEv;
   #uses interface Client self;
   #uses data viewKeyboard vewdatKeyboard;

   static boolean relevant(evtLoginRes ev)
   {
      return true;
   }

   context()
   {
       true;
   }
   #reasoning method
   body()
   {
      self.setLogStatus(logResEv.status);
      self.setLoginPendingStatus(false);
      self.setName(logResEv.user);

      if (logResEv.status == true)
      {
         self.setGroup("General");

         System.out.println("\n\n------------------------------------
\n");
         System.out.println("Welcome to the \"General\" chat
group!\n");
         System.out.println("------------------------------------
\n\n");

         //See below for an explanation why this line is no good:
//       System.out.print( (logResEv.getAgent()).name() + ": ");
//       System.out.println( "***You are '" +
(logResEv.getAgent()).name() + "' ***");
         System.out.println( "***You are '" + self.getUserName() + "'
***");
         String line = "";
         @action()
         {
            try
            {
               line = buf.readLine();
            } catch (IOException ioe) {
               System.err.println(ioe);
            }
         };
         StringTokenizer tokenizer = new StringTokenizer(line, " ");
         boolean logout = false;

         while ( !line.equals("logout") )
         {
            MessageEvent me = vewdatKeyboard.processLine(line);
            if ( me != null ) @send ( logResEv.from, me );

            //There is no good way to have this chat application
            //write a prompt line.  This old code:
//          System.out.print( (logResEv.getAgent()).name() + ": ");
            //does not work because it writes the prompt, goes into
            //buffer read-line mode, and *then* the other plan threads
            //spit out various feedback, which gets tacked at the end
            //of the prompt as a result.  Maybe we could implement
some
            //kind of critical-section semaphore or some such, but
it's
            //not worth the effort.  So we settle for this sort-of
prompt:
//          System.out.println( "***You are '" +
(logResEv.getAgent()).name() + "' ***");
            System.out.println( "***You are '" + self.getUserName() +
"' ***");
            @action()
            {
               try
               {
                  line = buf.readLine();
               } catch (IOException ioe) {
                  System.err.println(ioe);
               }
            };
         }

         if ( line.equals("logout") )
         {
            @send( logResEv.from, logoutEv.logout(logResEv.user) );
            System.out.println( "***Now exiting..." );
            System.exit(0);
         }
      } else {
         System.err.println("***ERROR: User '" + logResEv.user + "'
already logged in...Please wait...");
         //Don't we need to kill the agent here?  This was missing.
         self.finish();
      }
   }
}
//end plnProcessLoginRes
```

The evtJoinGrp event represents a request to join (and create, if necessary) a group. The group is the name of the group being joined, and user the name of the user joining the group.

```
// File: evtJoinGrp.event
package client;

/**
This event is sent from the Client to the Server agent as a request to
join a group.
 */
public event
evtJoinGrp
   extends MessageEvent
{
   public String group;
   public String user;

   #posted as
   join(String grp, String usr)
   {
      group = grp;
      user = usr;
   }
}
//end evtJoinGrp
```

The evtLeaveGrp event represents a request to leave a group. The group is the name of the group being left behind, and user the name of the user leaving the group.

```
// File: evtLeaveGrp.event
package client;

/**
This event triggers the removal of the user (sender) from the group
specified.
 */
public event
evtLeaveGrp
   extends MessageEvent
{
   public String group;
   public String user;

   #posted as
   leave(String grp, String usr)
   {
      group = grp;
      user = usr;
   }
}
//end evtLeaveGrp
```

The evtListGrp event represents a request to list the extant groups. It has no members.

```
// File: evtListGrp.event
package client;

/**
This event is sent from the Client agent to initiate the retrieval of
the group names that exist in the GroupList beliefset.
 */
public event
evtListGrp
   extends MessageEvent
{
   #posted as
   list() { ; }
}
//end evtListGrp
```

The evtLogout event indicates to the Server that the Client is withdrawing from the Chat network and shutting down. The user member is the name of the user shutting down.

```
// File: evtLogout.event
package client;

/**
This event initiates the logout procedure.
 */
public event
evtLogout
   extends MessageEvent
{
   public String user;

   #posted as
   logout(String username)
   {
      user = username;
   }
}
//end evtLogout
```

The `evtMessageGrp` represents a message being sent by the client to the members of a given group. The `fromUser` is the name of the user sending the message, the `group` is the target group, and `messg` is the message being sent.

```
// File: evtMessageGrp.event
package client;

/**
This event is an envelope for the data (including the message)
required to send a message from one user to all users of a particular
group.
 */
public event evtMessageGrp extends MessageEvent {
   public String fromUsr;
   public String group;
   public String messg;

   #posted as
   msgGrp(String msg, String grp, String user)
   {
      messg = msg;
      group = grp;
      fromUsr = user;
   }
}
//end evtMessageGrp
```

The `evtMessageUsr` represents a private message being sent by the client to a specific other user. The `fromUser` is the name of the user sending the message, the `toUser` is the target user, and `messg` is the message being sent.

```
// File: evtMessageUsr.event
package client;


/**
This event is an envelope for the data required (including the
message) to send a message from one user to another.
 */
public event evtMessageUsr extends MessageEvent {
   public String fromUsr;
   public String messg;
   public String toUsr;

   #posted as
   message(String msg, String to, String from)
   {
      messg = msg;
      toUsr = to;
      fromUsr = from;
   }
}//end evtMessageUsr
```

The `evtRequestGrpWho` event represents a request to list the currently visible other users (those in the same group). The `grp` is the group being queried (which could have been different from the current group in the original JACK demonstration.

```
// File: evtRequestGrpWho.event
package client;

/**
This event initiates the processing of the 'who' command.
 */
public event evtRequestGrpWho extends MessageEvent {
   public String group;

   #posted as
   grpWho(String grp)
   {
      group = grp;
   }
}
//end evtRequestGrpWho
```

The `MyObservable` class is a descendant of `java.util.Observable` adapted for use with the `aos.jack.util.cursor.Change` class.

```
// File: MyObservable.java
package server;

/*
 * MyObservable.java
 *
 * A simple, usable Observable.
 */
public class
MyObservable
   extends java.util.Observable
{
   //Stupidly, both clearChanged() and setChanged() are protected,
   //preventing use "out of the box" of java.util.Observable

   //Changing visibility from protected to public
   //Also changing behaviour somewhat:
   //if there are no observers yet, we simply flip to "changed";
   //otherwise we flip to "changed" and then notifyObservers
   //(and thus revert to unchanged).
   public void
   setChanged()
   {
      if (countObservers() > 0)
      {
         super.setChanged();
         notifyObservers();
      } else {
         super.setChanged();
      }
   }

   //Changing visibility from protected to public
   public  void
   clearChanged()
   {
      super.clearChanged();
   }
}
//end MyObservable
```

The `Server.agent` was extensively rewritten to adapt JACK to an HLA context. It is fairly large because of the `HLAchat` inner class, which reproduces the lower-level functionality of the Java Chat client.

A second development cycle would consist in re-organizing the Java code to follow more closely the JACK structure, and in merging the JACK Client and Server into a single Chatter agent. The Java `FederateAmbassador` functionalities could be separated from the GUI-related code and encapsulated into a stand-alone class. `MyChat` could then declare an inner class that descends directly from this class, and the agent's `HLAchat` inner class could do likewise. This would remove a large amount of code duplication.

```
// File: Server.agent
package server;

import java.io.File;
import java.util.HashMap;
import java.util.Iterator;
import hla.rti1516.*;
import se.pitch.prti1516.RTI;
import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import ca.gc.drdc_rddc.hla.rti1516.FedAmb.*;
import ca.gc.drdc_rddc.hla.rti1516.jack.capHLA1516;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipAcquisitionNo
tification;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipUnavailable;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributesInScope;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributesOutOfScope;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAdiscoverObjectInstance;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationFa
iled;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationSu
cceeded;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAprovideAttributeValueUpdate;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAreceiveInteraction;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAreflectAttributeValues;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAremoveObjectInstance;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipAssump
tion;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipReleas
e;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestDivestitureConfirmation;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAturnInteractionsOff;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAturnInteractionsOn;
import client.evtUserLogin;

/**
The Server agent represents the central server which processes all
data incoming from the users logged onto the chat network.
 */
public agent
Server
   extends Agent
{
   #has capability capHLA1516 capHLA;
   #has capability capProcessData cap;
   #handles event evtHLA_AcquireChatRoomRegistry;
   #handles event evtHLA_ForceDivest;
   #handles event evtHLA_ParticipantEntersGeneralChatRoom;
   #handles event evtHLAattributeOwnershipAcquisitionNotification;
   #handles event evtHLAattributeOwnershipUnavailable;
   #handles event evtHLAattributesInScope;
   #handles event evtHLAattributesOutOfScope;
   #handles event evtHLAdiscoverObjectInstance;
   #handles event evtHLAobjectInstanceNameReservationFailed;
   #handles event evtHLAobjectInstanceNameReservationSucceeded;
   #handles event evtHLAprovideAttributeValueUpdate;
   #handles event evtHLAreceiveInteraction;
   #handles event evtHLAreflectAttributeValues;
   #handles event evtHLAremoveObjectInstance;
   #handles event evtHLArequestAttributeOwnershipAssumption;
   #handles event evtHLArequestAttributeOwnershipRelease;
   #handles event evtHLArequestDivestitureConfirmation;
   #handles event evtHLAturnInteractionsOff;
   #handles event evtHLAturnInteractionsOn;
   #handles event evtUserLogin;

   #posts event evtHLA_AcquireChatRoomRegistry
evHLA_AcquireChatRoomRegistry;
   #posts event evtHLA_ForceDivest evHLA_ForceDivest;
   #posts event evtHLA_ParticipantEntersGeneralChatRoom
evHLA_ParticipantEntersGeneralChatRoom;

   #sends event evtLoginRes evLoginRes;
   #sends event evtRelayMessg evRelayMessg;

   #uses plan plnHLA_AcquireChatRoomRegistry;
   #uses plan plnHLA_ChatRoom_Discovery;
   #uses plan plnHLA_ChatRoom_OwnershipAcquisitionFailed;
   #uses plan plnHLA_ChatRoom_OwnershipAcquisitionNotification;
   #uses plan plnHLA_ChatRoom_OwnershipAssumptionRequest;
   #uses plan plnHLA_ChatRoom_OwnershipDivestitureConfirmationRequest;
   #uses plan plnHLA_ChatRoom_OwnershipReleaseRequest;
   #uses plan plnHLA_ChatRoom_ProvideAttributeValueUpdate;
   #uses plan plnHLA_ChatRoom_ReflectAttributeValueUpdate;
   #uses plan plnHLA_ChatRoom_Removal;

   #uses plan plnHLA_ChatRoomRegistry_Discovery;
   #uses plan plnHLA_ChatRoomRegistry_NameReservation_Failed;
   #uses plan plnHLA_ChatRoomRegistry_NameReservation_Succeeded;
   #uses plan plnHLA_ChatRoomRegistry_OwnershipAcquisitionFailed;
   #uses plan
plnHLA_ChatRoomRegistry_OwnershipAcquisitionNotification;
   #uses plan plnHLA_ChatRoomRegistry_OwnershipAssumptionRequest;
   #uses plan
plnHLA_ChatRoomRegistry_OwnershipDivestitureConfirmationRequest;
   #uses plan plnHLA_ChatRoomRegistry_OwnershipReleaseRequest;
   #uses plan plnHLA_ChatRoomRegistry_ProvideAttributeValueUpdate;
   #uses plan plnHLA_ChatRoomRegistry_ReflectAttributeValueUpdate;
   #uses plan plnHLA_ForceDivest;
   #uses plan plnHLA_Interaction;
   #uses plan plnHLA_InteractionScopeAdvisory_Off;
   #uses plan plnHLA_InteractionScopeAdvisory_On;

   #uses plan plnHLA_Participant_AttributeScopeAdvisory_In;
   #uses plan plnHLA_Participant_AttributeScopeAdvisory_Out;
   #uses plan plnHLA_Participant_Discovery;
   #uses plan plnHLA_Participant_NameReservation_Failed;
   #uses plan plnHLA_Participant_NameReservation_Succeeded;
   #uses plan plnHLA_Participant_OwnershipAcquisitionFailed;
   #uses plan plnHLA_Participant_OwnershipAcquisitionNotification;
   #uses plan plnHLA_Participant_OwnershipAssumptionRequest;
   #uses plan
plnHLA_Participant_OwnershipDivestitureConfirmationRequest;
   #uses plan plnHLA_Participant_OwnershipReleaseRequest;
   #uses plan plnHLA_Participant_ProvideAttributeValueUpdate;
   #uses plan plnHLA_Participant_ReflectAttributeValueUpdate;
   #uses plan plnHLA_ParticipantEntersGeneralChatRoom;
   #uses plan plnHLA_WaitingRoom_NameReservation_Failed;
   #uses plan plnHLA_WaitingRoom_NameReservation_Succeeded;
   #uses plan plnLoginUser;

   #private data blfHLA datHLA();
   #private data blfUsers blfdatUsers();

   /**
   * Server Agent constructor.
   */
   public Server(String name, String[] HLAargs)
   {
      super(name);
      //Note that super() must be the first statement,
      //so storing the HLAargs can't occur until the super's
      //consequences have run out (including the UserData View
constructor).
      //This is another reason why having any constructor invoke
      //_HLAchat.connect() is a bad idea.
      _HLAargs = HLAargs;
   } //constructor

   public String[] _HLAargs;
   /**
   //Exposing the event factories could be done like this:
   public evtHLAattributeOwnershipAcquisitionNotification
   getEvtHLAattributeOwnershipAcquisitionNotification()
   {
      return evHLAattributeOwnershipAcquisitionNotification;
   } //getEvtHLAattributeOwnershipAcquisitionNotification
   and so on...
    */
   //Exposing the inner class constructor
   //to circumvent a Plan pre-processor bug; once that is fixed,
   //we can replace calls to this with:
//      self.new HLAchat(capHLA, the_username)
   //where self is a Server instance reference and
   //capHLA is the HLAfederate's enclosing capHLA1516 instance.
   public HLAchat
   newHLAchat(String the_username)
      throws aos.jack.jak.beliefset.BeliefSetException
   {
      return this.new HLAchat(capHLA, the_username);
   } //newHLAchat

   // ###################################################
   // ##################### HLAchat #####################
   // ###################################################
   /*
    * HLAchat.java
    *
    * Based on the NetBeans MyChat.java application, this handles the
    * HLA interface of the JACK chat federation.
    * Besides the chat-specific stuff, the key interface layer here
    * consists of the FedAmbWrapper listener/responder stubs, which
    * simply rewrap the callback parameters into a JACK event.
    * An agent instance reference is needed for two main reasons:
    * 1) the agent supplies the postEvent and send methods
    * 2) the agent exposes (privately) the Event factories
    *    (as long as the agent declares that it posts or sends them)
    * Because the Event factories are built by the pre-processor,
    * their accessibility cannot be modified directly here; the best
    * that could be done would be to provide an access method.
    * Having the HLAchat class inner to the agent solves these
    * problems nicely.
    *
    * Note that the pRTI1516 classes dragged in by the RTIambassador
    * and FederateAmbassador turn out to be non-serializable (in their
    * innards), which means an HLAchat class cannot be wrapped into a
    * sent message (although it could still be posted). Since the
    * agent must manage several HLAchat instances in any case, putting
    * their references in a BeliefSet makes more sense. It becomes
    * relatively easy to recover the HLAchat reference as part of each
    * plan's context() method.
    */
   public class
   HLAchat
      extends ca.gc.drdc_rddc.hla.rti1516.jack.capHLA1516.HLAfederate
   {
      public static final int CRC_PORT = 8989;
      public static final String _name_ChatRoomRegistry      =
"_ChatRoomRegistry";
      public static final String _name_nowhere_ChatRoom      =
"_nowhere";
      public static final String _name_waiting_room_ChatRoom =
"_waiting_room";
      public static final String _name_general_ChatRoom      =
"_<General>";
      public static final short _slot_nowhere_ChatRoom      = 0;
      public static final short _slot_waiting_room_ChatRoom = 1;
      public static final short _slot_general_ChatRoom      = 2;
      public static final short _slot_FirstFreeChatRoomSlot = 3;

      private String                  rtiHost = "localhost";
//HLAargs[0]
//    private String                  fdd     = "C:\\Program
Files\\pRTI1516\\Samples\\chat\\MyChat.xml"; //HLAargs[1]
      private String                  fdd     = "D:\\Documents and
Settings\\dthibault\\Mes Documents\\Java Projects\\MyChat.xml";
//HLAargs[1]
      private String                  fedex   = "MyChatRoom";
//HLAargs[2]
      private String                  fedname = "MyChatter";
//HLAargs[3]
      private FederateHandle          _federateHandle;

      //References to the RTI and Federate ambassadors
      public RTIambassador           _rtiAmbassador; //returns
super.rtiAmbassador
      public FedAmbWrapper           _fedAmbassador;

      //The JACK username
      //Used to identify the HLAchat instance
//    public String                  username; //use
super.getIdentifier() instead

      //Whether HLA is connected or not (ie, whether the federate has
joined)
      public boolean connected = false;

      public InteractionClassHandle  _ich_Communication;
      public ParameterHandle         _iph_Communication_message;
      public ParameterHandle         _iph_Communication_sender;

      public ObjectClassHandle       _och_ChatRoomRegistry;
      public AttributeHandleSet      _oahs_ChatRoomRegistry;
      public AttributeHandleSet      _oahs_ChatRoomRegistry_forUpdate;
      public AttributeHandle
_oah_ChatRoomRegistry_DeletePrivilege;
      public AttributeHandle         _oah_ChatRoomRegistry_list;
      public AttributeHandleValueMap _oahvm_ChatRoomRegistry;
      public ObjectClassHandle       _och_ChatRoom;
      public AttributeHandleSet      _oahs_ChatRoom;
      public AttributeHandleSet      _oahs_ChatRoom_forUpdate;
      public AttributeHandle         _oah_ChatRoom_DeletePrivilege;
      public AttributeHandle         _oah_ChatRoom_slot;
      public AttributeHandle         _oah_ChatRoom_name;
//    public AttributeHandleValueMap _oahvm_ChatRoom;

      public ObjectClassHandle       _och_Participant;
      public AttributeHandleSet      _oahs_Participant;
      public AttributeHandleSet      _oahs_Participant_forUpdate;
//    public AttributeHandleSet      _oahs_Participant_chat_room_slot;
      public AttributeHandle         _oah_Participant_DeletePrivilege;
      public AttributeHandle         _oah_Participant_logged_in;
      public AttributeHandle         _oah_Participant_user_handle;
      public AttributeHandle         _oah_Participant_chat_room_slot;
//    public AttributeHandleValueMap _oahvm_Participant;

      public DimensionHandle         _dh_UserHandleSlots;
      public DimensionHandleSet      _dhs_UserHandleSlotsSet;
      public DimensionHandle         _dh_ChatRoomSlots;
      public DimensionHandleSet      _dhs_ChatRoomSlotsSet;

      //The handle of the Region matched to "_nowhere" (slot 0)
      public RegionHandle            _rh_nowhere_ChatRoom;
      public RegionHandleSet         _rhs_nowhere_ChatRoom;
      //The handle of the Region matched to the "_waiting_room"
ChatRoom (slot 1)
      public RegionHandle            _rh_waiting_room_ChatRoom;
      public RegionHandleSet         _rhs_waiting_room_ChatRoom;
      //The handle of the Region matched to the "<General>" ChatRoom
(slot 2)
      public RegionHandle            _rh_general_ChatRoom;
      public RegionHandleSet         _rhs_general_ChatRoom;
      //The handle of the Region matched to our current ChatRoom, if
any (null otherwise)
      public RegionHandle            _rh_current_ChatRoom;
      public RegionHandleSet         _rhs_current_ChatRoom;
      //The handle of the Region matched to our current UserHandle, if
any (null otherwise)
      public RegionHandle            _rh_myParticipantRegion;
      public RegionHandleSet         _rhs_myParticipantRegion;

      //The list (size 2) of AttributeSet-RegionSet pairs used for
Participant publish/subscribe
      //The AttributeSet will always be _oahs_Participant_forUpdate;
      //the RegionSet will always be one of _rh_nowhere_ChatRoom,
_rh_waiting_room_ChatRoom or _rh_current_ChatRoom
      public AttributeSetRegionSetPairList
_asrspl_Participant_nowhere;
      public AttributeSetRegionSetPairList
_asrspl_Participant_waiting_room;
      public AttributeSetRegionSetPairList
_asrspl_Participant_current;
```

```
      public boolean _me_logged_in     = false;
      public boolean _me_logging_in    = false;
      public boolean _alone            = true;
      public boolean _me_shutting_down = false;

      //The unique ChatRoomRegistry object instance
      public aChatRoomRegistry _ChatRoomRegistry = null;
      //The ChatRoomRegistry Semaphore, used in lieu of
synchronized(_ChatRoomRegistry)
      public aos.jack.util.thread.Semaphore _sem_ChatRoomRegistry =
new aos.jack.util.thread.Semaphore();

      //The nowhere_ChatRoom is never instantiated
      //The waiting_room ChatRoom
      final public aChatRoom _waiting_room_ChatRoom = new
aChatRoom(_name_waiting_room_ChatRoom, _slot_waiting_room_ChatRoom);
      //The general ChatRoom
      public aChatRoom _general_ChatRoom; // = new
aChatRoom(_name_general_ChatRoom, _slot_general_ChatRoom);
      //The ChatRoom we're in
      public aChatRoom _myChatRoom;
      //The set of ChatRooms (keys are ObjectInstanceHandle, values
are aChatRoom)
      public HashMap _theChatRooms = new HashMap();
      //The ChatRooms Semaphore, used in lieu of
synchronized(_theChatRooms)
      public aos.jack.util.thread.Semaphore _sem_theChatRooms = new
aos.jack.util.thread.Semaphore();
      //Note that JACK usually defines a Semaphore at the Agent level,
      //but in our case it must be at the HLAchat instance level

      public aParticipant _me = new aParticipant();
      //The _me Semaphore, used in lieu of synchronized(_me)
      public aos.jack.util.thread.Semaphore _sem_me = new
aos.jack.util.thread.Semaphore();
      //List of known Participants (including ourselves); keys are
ObjectInstanceHandles, values are aParticipant objects
      public HashMap _theParticipants = new HashMap();
      //The Participants Semaphore, used in lieu of
synchronized(_theParticipants)
      public aos.jack.util.thread.Semaphore _sem_theParticipants = new
aos.jack.util.thread.Semaphore();
```

```
      //Set of observable semaphores
      //Name reservation semaphore
      public MyObservable sem_name_reservation = new MyObservable();
      //ChatRoomRegistry Discovery semaphore
      public MyObservable sem_ChatRoomRegistry_discovery = new
MyObservable();
      //ChatRoomRegistry Acquisition semaphore
      public MyObservable sem_ChatRoomRegistry_acquisition = new
MyObservable();
      //ChatRoomRegistry Divestiture semaphore
      public MyObservable sem_ChatRoomRegistry_divestiture = new
MyObservable();
      //ChatRoom Discovery semaphore
      public MyObservable sem_ChatRoom_discovery = new MyObservable();
      //ChatRoom Acquisition semaphore
      public MyObservable sem_ChatRoom_acquisition = new
MyObservable();
      //ChatRoom Divestiture semaphore
      public MyObservable sem_ChatRoom_divestiture = new
MyObservable();
      //Participant Discovery semaphore
      public MyObservable sem_Participant_discovery = new
MyObservable();
      //Participant Acquisition semaphore
      public MyObservable sem_Participant_acquisition = new
MyObservable();
      //Participant Divestiture semaphore
      public MyObservable sem_Participant_divestiture = new
MyObservable();
```

```
      /**
       * Constructor for HLAchat.
       * Because HLAchat extends
ca.gc.drdc_rddc.hla.rti1516.jack.capHLA1516.HLAfederate,
       * the constructor needs a reference to the HLAfederate's
enclosing instance (the capability)
       */
      public
      HLAchat(ca.gc.drdc_rddc.hla.rti1516.jack.capHLA1516 the_cap,
String the_username)
         throws aos.jack.jak.beliefset.BeliefSetException
      {
         //Until the pre-processor bug is fixed, we cannot do this:
//       the_cap.super(the_username);
         //To get around the bug, compile with the above line
         //commented out, then edit Server.java to uncomment the line
         //and recompile Server.class.
         //super constructor registers the_username with datHLA;
         //throws aos.jack.jak.beliefset.BeliefSetException if already
in use
         System.out.println( "HLAchat connecting..." );
         connected = joinFederation();
         if (!connected) return;
         System.out.println( "HLAchat connected..." );
         if (!getHandles()) return;
         System.out.println( "HLAchat handles obtained..." );
         try {
            _ChatRoomRegistry = new aChatRoomRegistry(); //We couldn't
do this in the field declarations because of the escaping Exception
         } catch (CouldNotDecode ignored) {} //try
         //We let the plans do the dispatching at the Relevance level,
so we do:

         //Freeing up the other Semaphores
         _sem_ChatRoomRegistry.signal();
         _sem_theChatRooms.signal();
         _sem_theParticipants.signal();
         _sem_me.signal();

         System.out.println( "HLAchat initialisation complete" );
      } //constructor

      private boolean
      joinFederation()
      {
         //Remaining initialisation
         try
         {
            //Process the command-line arguments, if any
//          if (Server.this._HLAargs != null)
            if (_HLAargs != null)
            {
               if (_HLAargs.length > 0) rtiHost = _HLAargs[0];
               if (_HLAargs.length > 1) fdd     = _HLAargs[1];
               if (_HLAargs.length > 2) fedex   = _HLAargs[2];
               if (_HLAargs.length > 3) fedname = _HLAargs[3];
            } //if
            //Get the RTIambassador
            try
            {
               _rtiAmbassador = rtiAmbassador = RTI.getRTIambassador(
rtiHost, CRC_PORT );
            } catch (Exception e) {
               System.out.println( "+++ HLAchat: Unable to connect to
CRC on " + rtiHost + ":" + CRC_PORT );
               return false;
            } //try
            System.out.println( "HLAchat initialising - RTIambassador
obtained" );

            //Destroy any lingering empty federation execution
            try
            {
               _rtiAmbassador.destroyFederationExecution( fedex );
               System.out.println( "HLAchat initialising - Previous "
+ fedex + " federation destroyed" );
            } catch (FederatesCurrentlyJoined ignored) {
            } catch (FederationExecutionDoesNotExist ignored) {
            } //try

            //Create the federation execution
            final File fddFile = new File(fdd);
            try
            {
               _rtiAmbassador.createFederationExecution( fedex,
fddFile.toURL() );
               System.out.println( "HLAchat initialising - " + fedex +
" federation created" );
            } catch (FederationExecutionAlreadyExists ignored) {
            } catch (CouldNotOpenFDD cnof) {
               System.out.println( "+++ HLAchat: Could not open FDD '"
+ fddFile.getAbsoluteFile().toString() + "'" );
               return false;
            } catch (ErrorReadingFDD erf) {
               System.out.println( "+++ HLAchat: Corrupt FDD '" +
fddFile.getAbsoluteFile().toString() + "'" );
               return false;
            } //try

            //Join the federation execution
            _federateHandle = _rtiAmbassador.joinFederationExecution(
fedname, fedex, this, null );
            System.out.println( "HLAchat initialising - Joined as " +
_federateHandle );
            return true;
         } catch (Exception e) {
            e.printStackTrace();
            return false;
         } //try
      } //joinFederation
      public void
      resignFederationExecution()
      {
         try
         {
            //Any remaining owned objects will be deleted (there
should be none when !_alone, really) (well, maybe some Region
objects...)
            System.out.println( "HLAchat shutting down - Resigning
from federation" );
            _rtiAmbassador.resignFederationExecution(
ResignAction.DELETE_OBJECTS_THEN_DIVEST );
            //OwnershipAcquisitionPending, FederateOwnsAttributes,
FederateNotExecutionMember, RTIinternalError
            try
            {
               _rtiAmbassador.destroyFederationExecution( fedex );
               //FederatesCurrentlyJoined,
FederationExecutionDoesNotExist, RTIinternalError
            } catch (FederatesCurrentlyJoined ignored) {
            }
            System.out.println( "HLAchat shutting down - Federation "
+ fedex + " destroyed" );
            connected = false;
         } catch (RTIexception e) {
            e.printStackTrace();
         } //try
      } //resignFederationExecution

      private boolean
      getHandles()
      {
         try
         {
            //Obtain object/interaction and parameter/attribute
handles
            _ich_Communication =
_rtiAmbassador.getInteractionClassHandle( "Communication" );
            _iph_Communication_message =
_rtiAmbassador.getParameterHandle( _ich_Communication, "message" );
            _iph_Communication_sender =
_rtiAmbassador.getParameterHandle( _ich_Communication, "sender" );
```

```
            _och_ChatRoomRegistry =
_rtiAmbassador.getObjectClassHandle( "ChatRoomRegistry" );
            _oah_ChatRoomRegistry_DeletePrivilege =
_rtiAmbassador.getAttributeHandle( _och_ChatRoomRegistry,
RTI.PrivilegeToDeleteObjectName ); //"HLAprivilegeToDeleteObject" );
            _oah_ChatRoomRegistry_list            =
_rtiAmbassador.getAttributeHandle( _och_ChatRoomRegistry, "list" );
            //Build the attribute handle sets
            _oahs_ChatRoomRegistry =
_rtiAmbassador.getAttributeHandleSetFactory().create();
            _oahs_ChatRoomRegistry.add( _oah_ChatRoomRegistry_list );
            _oahs_ChatRoomRegistry.add(
_oah_ChatRoomRegistry_DeletePrivilege );
            _oahs_ChatRoomRegistry_forUpdate =
_rtiAmbassador.getAttributeHandleSetFactory().create();
            _oahs_ChatRoomRegistry_forUpdate.add(
_oah_ChatRoomRegistry_list );

            _och_ChatRoom = _rtiAmbassador.getObjectClassHandle(
"ChatRoom" );
            _oah_ChatRoom_DeletePrivilege =
_rtiAmbassador.getAttributeHandle( _och_ChatRoom,
RTI.PrivilegeToDeleteObjectName );
            _oah_ChatRoom_name = _rtiAmbassador.getAttributeHandle(
_och_ChatRoom, "name" );
            _oah_ChatRoom_slot = _rtiAmbassador.getAttributeHandle(
_och_ChatRoom, "slot" );
            //Build the attribute handle sets
            _oahs_ChatRoom =
_rtiAmbassador.getAttributeHandleSetFactory().create();
            _oahs_ChatRoom.add( _oah_ChatRoom_DeletePrivilege );
            _oahs_ChatRoom.add( _oah_ChatRoom_name );
            _oahs_ChatRoom.add( _oah_ChatRoom_slot );
            _oahs_ChatRoom_forUpdate =
_rtiAmbassador.getAttributeHandleSetFactory().create();
            _oahs_ChatRoom_forUpdate.add( _oah_ChatRoom_name );
            _oahs_ChatRoom_forUpdate.add( _oah_ChatRoom_slot );

            _och_Participant = _rtiAmbassador.getObjectClassHandle(
"Participant" );
            _oah_Participant_DeletePrivilege =
_rtiAmbassador.getAttributeHandle( _och_Participant,
RTI.PrivilegeToDeleteObjectName );
            _oah_Participant_logged_in       =
_rtiAmbassador.getAttributeHandle( _och_Participant, "logged_in" );
            _oah_Participant_user_handle     =
_rtiAmbassador.getAttributeHandle( _och_Participant, "user_handle" );
            _oah_Participant_chat_room_slot  =
_rtiAmbassador.getAttributeHandle( _och_Participant, "chat_room_slot"
);
```

```
            //Build the attribute handle sets
            _oahs_Participant =
_rtiAmbassador.getAttributeHandleSetFactory().create();
            _oahs_Participant.add( _oah_Participant_DeletePrivilege );
            _oahs_Participant.add( _oah_Participant_logged_in );
            _oahs_Participant.add( _oah_Participant_user_handle );
            _oahs_Participant.add( _oah_Participant_chat_room_slot );
            _oahs_Participant_forUpdate =
_rtiAmbassador.getAttributeHandleSetFactory().create();
            _oahs_Participant_forUpdate.add(
_oah_Participant_logged_in );
            _oahs_Participant_forUpdate.add(
_oah_Participant_user_handle );
            _oahs_Participant_forUpdate.add(
_oah_Participant_chat_room_slot );
//          _oahs_Participant_chat_room_slot =
_rtiAmbassador.getAttributeHandleSetFactory().create();
//          _oahs_Participant_chat_room_slot.add(
_oah_Participant_chat_room_slot );

            _dh_UserHandleSlots = _rtiAmbassador.getDimensionHandle(
"UserHandleSlots" );
            _dh_ChatRoomSlots   = _rtiAmbassador.getDimensionHandle(
"ChatRoomSlots" );
            _dhs_UserHandleSlotsSet =
_rtiAmbassador.getDimensionHandleSetFactory().create();
            _dhs_UserHandleSlotsSet.add( _dh_UserHandleSlots );
            _dhs_ChatRoomSlotsSet =
_rtiAmbassador.getDimensionHandleSetFactory().create();
            _dhs_ChatRoomSlotsSet.add( _dh_ChatRoomSlots );

            _rhs_nowhere_ChatRoom =
_rtiAmbassador.getRegionHandleSetFactory().create();
            _rh_nowhere_ChatRoom = _rtiAmbassador.createRegion(
_dhs_ChatRoomSlotsSet );
            //_nowhere_ChatRoom is slot 0
            _rtiAmbassador.setRangeBounds( _rh_nowhere_ChatRoom,
_dh_ChatRoomSlots, new RangeBounds( _slot_nowhere_ChatRoom, 1 +
_slot_nowhere_ChatRoom ) );
            _rhs_nowhere_ChatRoom.add( _rh_nowhere_ChatRoom );
            _rtiAmbassador.commitRegionModifications(
_rhs_nowhere_ChatRoom );

            _rhs_waiting_room_ChatRoom =
_rtiAmbassador.getRegionHandleSetFactory().create();
            _rh_waiting_room_ChatRoom = _rtiAmbassador.createRegion(
_dhs_ChatRoomSlotsSet );
            //_waiting_room_ChatRoom is slot 1
            _rtiAmbassador.setRangeBounds( _rh_waiting_room_ChatRoom,
_dh_ChatRoomSlots, new RangeBounds( _slot_waiting_room_ChatRoom, 1 +
_slot_waiting_room_ChatRoom ) );
            _rhs_waiting_room_ChatRoom.add( _rh_waiting_room_ChatRoom
);
            _rtiAmbassador.commitRegionModifications(
_rhs_waiting_room_ChatRoom );
```

```
            //The General ChatRoom
            _rhs_general_ChatRoom =
_rtiAmbassador.getRegionHandleSetFactory().create();
            _rh_general_ChatRoom = _rtiAmbassador.createRegion(
_dhs_ChatRoomSlotsSet );
            //General ChatRoom is slot 2
            _rtiAmbassador.setRangeBounds( _rh_general_ChatRoom,
_dh_ChatRoomSlots, new RangeBounds( _slot_general_ChatRoom, 1 +
_slot_general_ChatRoom ) );
            _rhs_general_ChatRoom.add( _rh_general_ChatRoom );
            _rtiAmbassador.commitRegionModifications(
_rhs_general_ChatRoom );

//          _rh_current_ChatRoom = null;
//          _rh_myParticipantRegion = null;
            //For chat_room_slot filtering, we associate all
"forUpdate" attributes to _dh_ChatRoomSlots regions
            //We'd get InvalidRegionContext when subscribing if we
included the DeletePrivilege
            _asrspl_Participant_nowhere =
_rtiAmbassador.getAttributeSetRegionSetPairListFactory().create(1);
            _asrspl_Participant_nowhere.add( new
AttributeRegionAssociation( _oahs_Participant_forUpdate,
_rhs_nowhere_ChatRoom ) );
            _asrspl_Participant_waiting_room =
_rtiAmbassador.getAttributeSetRegionSetPairListFactory().create(1);
            _asrspl_Participant_waiting_room.add( new
AttributeRegionAssociation( _oahs_Participant_forUpdate,
_rhs_waiting_room_ChatRoom ) );
            //There'll be no Communication traffic through the
waiting_room; this is used only to find out
            //(through the Interaction Advisories) whether there are
other federates or not.
            return true;
         } catch (Exception e) {
            e.printStackTrace();
            return false;
         } //try
      } //getHandles
      public void
      doUnsubscribe()
      {
         try
         {
            _rtiAmbassador.unsubscribeInteractionClassWithRegions(
_ich_Communication, _rhs_waiting_room_ChatRoom );

            _rtiAmbassador.unsubscribeObjectClassAttributes(
_och_ChatRoom, _oahs_ChatRoom_forUpdate );

_rtiAmbassador.unsubscribeObjectClassAttributesWithRegions(
_och_Participant, _asrspl_Participant_waiting_room );

            _rtiAmbassador.unsubscribeObjectClassAttributes(
_och_ChatRoomRegistry, _oahs_ChatRoomRegistry_forUpdate );
         } catch (Exception e) {
            e.printStackTrace();
         } //try
      } //doUnsubscribe

      public void
      doUnpublish()
      {
         try
         {
            _rtiAmbassador.unpublishInteractionClass(
_ich_Communication );

            _rtiAmbassador.unpublishObjectClassAttributes(
_och_ChatRoom, _oahs_ChatRoom_forUpdate );
            //unassociateRegionsForUpdates can only be done on a per-
instance basis
            _rtiAmbassador.unpublishObjectClassAttributes(
_och_Participant, _oahs_Participant_forUpdate );

            _rtiAmbassador.unpublishObjectClassAttributes(
_och_ChatRoomRegistry, _oahs_ChatRoomRegistry_forUpdate );
         } catch (Exception e) {
            e.printStackTrace();
         } //try
      } //doUnpublish

      //Should be called when shutting down (by the garbage collector)
      public void finalize()
         throws Throwable
      {
         super.finalize();
      } //finalize
```

```
// ########################### Utilities ###########################

      /**
       * The various Seek utilities need to synchronize on the HashMap
       * being searched; within a Java thread, this is done through
       * the Semaphore.threadWait() method.
       * Within a Plan, however, this is done through
       * @wait_for( Semaphore.planWait() ) and the two shall not mix.
       * Although these methods are within a Java object, they are all
       * called from within a Plan, so what shall we do?
       * We could make them subtasks (i.e. stand-alone Plans with
       * corresponding Events) but this seems too much overhead.
       * So instead we move the synchronization outside the methods,
       * to the invoking Plans.
       *
       * There turns out to be much less need for synchronization
       * anyway; since there is but one Server agent, it keeps only
       * one Plan active at a time, and the default
       * SimpleTaskManager takes a "depth-first" approach.  This means
       * a Plan is suspended only by a wait_for.  FederateAmbassador
       * callbacks are all sent to the Server's posting queue, so a
       * certain sequentiality is maintained.
       * The Java HLA chat agent was much harder to code because it
       * involved a proliferation of threads.
       */

      /**
       * This utility method finds the Participant object in the
hashmap by its ObjectInstanceHandle.
       * @param theObject an ObjectInstanceHandle specifying the
Participant sought
       * @return the sought Participant object, or null if not present
       */
      public aParticipant
      SeekParticipant(ObjectInstanceHandle theObject)
      {
         return (aParticipant)_theParticipants.get(theObject);
      } //SeekParticipant

      /**
       * This utility method finds the ChatRoom object in the hashmap
by its ObjectInstanceHandle.
       * @param theObject an ObjectInstanceHandle specifying the
ChatRoom sought
       * @return the sought ChatRoom object, or null if not present
       */
      public aChatRoom
      SeekChatRoom(ObjectInstanceHandle theObject)
      {
         return (aChatRoom)_theChatRooms.get(theObject);
      } //SeekChatRoom
      /**
       * This utility method finds the ChatRoom object in the hashmap
by its name.
       * @param name a String specifying the ChatRoom.name sought
       * @return the sought ChatRoom object, or null if not present
       */
      public aChatRoom
      SeekChatRoomByName(String name)
      {
         aChatRoom _ChatRoom;
         for (Iterator i = _theChatRooms.entrySet().iterator();
i.hasNext();)
         {
            _ChatRoom =
(aChatRoom)((java.util.Map.Entry)i.next()).getValue();
            if (_ChatRoom.name.toString().equals(name)) return
_ChatRoom;
         } //for
         return null;
      } //SeekChatRoomByName

      /**
       * This utility method finds the ChatRoom object in the hashmap
by its slot.
       * @param slot a short specifying the ChatRoom.slot sought
       * @return the sought ChatRoom object, or null if not present
       */
      public aChatRoom
      SeekChatRoomBySlot(short slot)
      {
         aChatRoom _ChatRoom;
         for (Iterator i = _theChatRooms.entrySet().iterator();
i.hasNext();)
         {
            _ChatRoom =
(aChatRoom)((java.util.Map.Entry)i.next()).getValue();
            if (_ChatRoom.slot.getValue() == slot) return _ChatRoom;
         } //for
         return null;
      } //SeekChatRoomBySlot
      /**
       * This utility method finds the Participant object in the
hashmap by its name.
       * @param name a String specifying the Participant.name sought
       * @return the sought Participant object, or null if not present
       */
      public aParticipant
      SeekParticipantByName(String name)
      {
         aParticipant _Participant;
         for (Iterator i = _theParticipants.entrySet().iterator();
i.hasNext();)
         {
            _Participant =
(aParticipant)((java.util.Map.Entry)i.next()).getValue();
            if (_Participant.name.toString().equals(name)) return
_Participant;
         } //for
         return null;
      } //SeekParticipantByName

      /**
       * This utility method finds the Participant object in the
hashmap by its user_handle.
       * @param user_handle an int specifying the
Participant.user_handle sought
       * @return the sought Participant object, or null if not present
       */
      public aParticipant
      SeekParticipantByUserHandle(int user_handle)
      {
         aParticipant _Participant;
         for (Iterator i = _theParticipants.entrySet().iterator();
i.hasNext();)
         {
            _Participant =
(aParticipant)((java.util.Map.Entry)i.next()).getValue();
            if (_Participant.user_handle.getValue() == user_handle)
return _Participant;
         } //for
         return null;
      } //SeekParticipantByUserHandle
```

```
// ######################## aChatRoomRegistry ########################

      public class
      aChatRoomRegistry
      {
         //Whether we own the object or not
         public boolean
         owned = false;
         //Whether we subscribe to the object class or not
         //(and therefore whether the value is up to date or not)
         public boolean
         subscribed = false;
         //Whether we are divesting the object or not (makes sense
only if owned)
         public boolean
         divesting = false;
         //The ChatRoomRegistry object's name
         final public String
         name = _name_ChatRoomRegistry;
         //The ChatRoomRegistry object's handle
         public ObjectInstanceHandle
         handle = null;
         //The ChatRoomRegistry object's list field
         public HLAChatRoomRegistryEntries
         list;

         /**
          * Default constructor; the name is unique and the list pre-
loaded with the "waiting_room" and <General>" ChatRooms.
          */
         public
         aChatRoomRegistry()
            throws CouldNotDecode
         {
            list = new HLAChatRoomRegistryEntries();
            list.add( list.size(), new HLAChatRoomRegistryEntry( new
HLAunicodeString( _name_waiting_room_ChatRoom ), new HLAinteger16BE(
_slot_waiting_room_ChatRoom ) ) );
            list.add( list.size(), new HLAChatRoomRegistryEntry( new
HLAunicodeString( _name_general_ChatRoom ), new HLAinteger16BE(
_slot_general_ChatRoom ) ) );
         } //constructor
      } //aChatRoomRegistry

      /**
      //Exposing the constructor
      public aChatRoomRegistry
      getNewChatRoomRegistry()
      {
         return new aChatRoomRegistry();
      } //getNewChatRoomRegistry
       */
      /**
       * Used by various methods to remove a ChatRoom from the
registry and update the latter.
       * Remember that the ChatRoomRegistry only maps ChatRoom names
to slots; it does not link
       * to ChatRoom object instances at all.
       * @param slot a short specifying the ChatRoom entry to remove
       */
      public void
      RemoveChatRoomAndUpdateRegistry(short slot)
      {
         //Presumes _ChatRoomRegistry has been synchronized on
         try
         {
            boolean updateNeeded = false;
            if (slot <= _slot_general_ChatRoom) return; //waiting_room
and General are fixtures
            for ( int i = 0; i < _ChatRoomRegistry.list.size(); i++ )
            {
               if ( slot == (
(HLAChatRoomRegistryEntry)_ChatRoomRegistry.list.get(i)
).slot.getValue() )
               {
                  _ChatRoomRegistry.list.remove(i);
                  updateNeeded = true;
                  break;
               } //if
            } //for
            if (!updateNeeded) return;
            AttributeHandleValueMap _ahvm_ChatRoomRegistry =
_rtiAmbassador.getAttributeHandleValueMapFactory().create(
_oahs_ChatRoomRegistry_forUpdate.size() );
            _ahvm_ChatRoomRegistry.put( _oah_ChatRoomRegistry_list,
_ChatRoomRegistry.list.toByteArray() );
            _rtiAmbassador.updateAttributeValues(
_ChatRoomRegistry.handle, _ahvm_ChatRoomRegistry, null );
         } catch (Exception ignored) {
         }
      } //RemoveChatRoomAndUpdateRegistry
      /**
       * Used by various methods to add a ChatRoom to the registry and
update the latter.
       * The ChatRoom is also added to _theChatRooms
       * @param name a String specifying the ChatRoom name to give to
the new entry (it'll be prefixed by the method)
       * @return the newly created aChatRoom object (null in case of
failure)
       */
      public aChatRoom
      AddChatRoomAndUpdateRegistry(String name)
      {
         //Presumes _ChatRoomRegistry has been synchronized on
         try
         {
            //To allow user names and chat room names to be anything,
the latter will be prefixed
            //by "p" and "c", respectively, whilst our reserved names
will be prefixed by "_"
            String newChatRoomName = "c" + name;
            aChatRoom _ChatRoom = SeekChatRoomByName(newChatRoomName);
            if (_ChatRoom != null) return null;
            //At this point we know the name is OK; now find a slot
number
            short candidate = _slot_FirstFreeChatRoomSlot;
            //Synchronization on _theChatRooms would normally be
required but we'll omit it here
            for ( ; null != SeekChatRoomBySlot(candidate);
candidate++);
            //We'll use candidate for the slot value
            _ChatRoomRegistry.list.add( _ChatRoomRegistry.list.size(),
new HLAChatRoomRegistryEntry( newChatRoomName, new HLAinteger16BE(
candidate ) ) );
            AttributeHandleValueMap _ahvm_ChatRoomRegistry =
_rtiAmbassador.getAttributeHandleValueMapFactory().create(
_oahs_ChatRoomRegistry_forUpdate.size() );
            _ahvm_ChatRoomRegistry.put( _oah_ChatRoomRegistry_list,
_ChatRoomRegistry.list.toByteArray() );
            _rtiAmbassador.updateAttributeValues(
_ChatRoomRegistry.handle, _ahvm_ChatRoomRegistry, null );

            _ChatRoom = new aChatRoom( newChatRoomName, candidate );
            _ChatRoom.owned = _ChatRoom.subscribed = true;
//          synchronized(_theChatRooms)
            {
               _theChatRooms.put( _ChatRoom.handle =
_rtiAmbassador.registerObjectInstance( _och_ChatRoom ), _ChatRoom );
            } //synchronized(_theChatRooms)
            return _ChatRoom;
         } catch (Exception ignored) {
         }
         return null;
      } //AddChatRoomAndUpdateRegistry
```

```
// ########################### aChatRoom ###########################

      public class
      aChatRoom
      {
         //Whether we own the object or not
         public boolean
         owned = false;
         //Whether we subscribe to the object class or not
         //(and therefore whether the value is up to date or not)
         public boolean
         subscribed = false;
         //Whether we are divesting the object or not (makes sense
only if owned)
         public boolean
         divesting = false;
         //The object's handle
         public ObjectInstanceHandle
         handle = null;
         //The ChatRoom object's name field
         public HLAunicodeString
         name;
         //The ChatRoom object's slot field
         public HLAinteger16BE
         slot;

         /**
          * Constructs a chat room named "unknown" with slot -1 (an
illegal value, really).
          */
         public
         aChatRoom()
         {
            this( "unknown", (short)-1 );
         } //constructor

         /**
          * Constructs a chat room of the specified name and slot.
          * @param aName a String specifying the ChatRoom's name field
value
          * @param aSlot a Short specifying the ChatRoom's slot field
value
          */
         public
         aChatRoom(String aName, short aSlot)
         {
            slot = new HLAinteger16BE(aSlot);
            name = new HLAunicodeString(aName);
         } //constructor
      } //aChatRoom
      //Exposing the constructors (until the Plan pre-processor bug is
fixed)
      public aChatRoom
      getNewChatRoom()
      {
         return new aChatRoom("unknown", (short)-1);
      } //getNewChatRoom

      public aChatRoom
      getNewChatRoom(String aName, short aSlot)
      {
         return new aChatRoom(aName, aSlot);
      } //getNewChatRoom

// ########################## aParticipant ##########################

      public class
      aParticipant
      {
         //Whether we own the object or not
         public boolean
         owned = false;
         //Whether we subscribe to the object class or not
         //(and therefore whether the value is up to date or not)
         public boolean
         subscribed = false;
         //Whether we are divesting the object or not (makes sense
only if owned)
         public boolean
         divesting = false;
         //Whether the object is in scope or not (relevant only if
owned is false)
         //(we're forced to do this instead of localDelete)
         public boolean
         inscope = false;
         //The object's handle
         public ObjectInstanceHandle
         handle = null;
         //The object's name
         public HLAunicodeString
         name = new HLAunicodeString();
         //The logged-in field
         public HLAboolean
         logged_in;
         //The user handle field
         public HLAinteger32BE
         user_handle;
         //The current chat room slot field
         public HLAinteger16BE
         chat_room_slot;
         /**
          * Default constructor; the name is empty, logged_in is
HLAfalse,
          * user_handle is 0 and chat_room_slot is 0 (waiting_room).
          */
         public
         aParticipant()
         {
            logged_in = new HLAboolean(false);
            user_handle = new HLAinteger32BE(0);
            chat_room_slot = new HLAinteger16BE(
_slot_nowhere_ChatRoom );
         } //constructor
      } //aParticipant

      //Exposing the constructor (until the Plan pre-processor bug is
fixed)
      public aParticipant
      getNewParticipant()
      {
         return new aParticipant();
      } //getNewParticipant

// #################### Listeners and Responders ####################

      /**
       * Where the Java application builds various FedAmb
       * Listener/Responder classes which the FedAmbWrapper dispatches
       * based on the callback's key parameter (typically the
       * interaction or object class), here we instead rely on the
       * generic listeners/responders which each post an event --the
       * FedAmbWrapper would have these set up using the null
       * discriminant. Dispatching now occurs at the plan level: each
       * HLA event is handled by a variety of plans, each with
       * different Relevance conditions (based on the event's key
       * field).
       */

      /**
       * To invoke an inner constructor from outside the class,
       * you must use an instance of the enclosing class, like this:
       *    instance_of_Server.new
MyInteractionAdvisoryResponder(instance_of_HLAchat)
       */
      /**
       * Because the JACK event classes are public, in the same
       * package, and expose publicly the posting methods, we
       * could systematically have each handler do:
       *    _server.postEvent( (new
evtHLAinteractionScopeAdvisory()).create(_HLAchat, <HLA arguments>) );
       * ...except that this causes a NullPointerException in the JACK
       * posting internals.
       * Instead, we must have the Server agent "post" each event to
       * force it to create the factories, and then add public methods
       * to make these (private) factories available here:
       *    _server.postEvent(
_server.getEvtHLAinteractionScopeAdvisory().create(_HLAchat, <HLA
arguments>) );
       * Alternately, any inner class of the agent can access the
       * instances directly since private access extends to the
       * enclosing class' body (in this case the agent).
       */
   } //HLAchat
}
//end Server
```

The `blfUsers` belief set is used by the Server to map usernames to the Client agent instance names.

```
// File: blfUsers.bel
package server;

/**
The Users beliefset maps a username to the corresponding agent's full
name (with the portal name).
 */
public beliefset blfUsers extends ClosedWorld {
   #key field String location;
   #key field String username;
   #indexed query get(String location, String username);
   #indexed query get(logical String location, String username);
   #indexed query get(logical String location, logical String
username);
   #indexed query get(String location, logical String username);
}
//end blfUsers
```

The `capProcessData` capability regroups the events the Server receives from its Clients.

```
// File: capProcessData.cap
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import client.evtJoinGrp;
import client.evtLeaveGrp;
import client.evtListGrp;
import client.evtLogout;
import client.evtMessageGrp;
import client.evtMessageUsr;
import client.evtRequestGrpWho;

/**
This capability implements the Server agent's data processing.
 */
public capability
capProcessData
   extends Capability
{
   #handles external event evtJoinGrp;
   #handles external event evtLeaveGrp;
   #handles external event evtListGrp;
   #handles external event evtLogout;
   #handles external event evtMessageGrp;
   #handles external event evtMessageUsr;
   #handles external event evtRequestGrpWho;
   #posts external event evtHLA_AcquireChatRoomRegistry
evHLA_AcquireChatRoomRegistry;
   #posts external event evtHLA_ForceDivest evHLA_ForceDivest;
   #posts external event evtJoinGrp evJoinGrp;
   #sends event evtGrpName evGrpName;
   #sends event evtGrpWhoRes evGrpWhoRes;
   #sends event evtJoinRes evJoinRes;
   #sends event evtLeaveGrpRes evLeaveGrpRes;
   #sends event evtMessageUsrRes evMessageUsrRes;
   #sends event evtNoGrp evNoGrp;
   #uses plan plnJoinGrp;
   #uses plan plnLeaveGrp;
   #uses plan plnListGrp;
   #uses plan plnLogoutUsr;
   #uses plan plnMessageGrp;
   #uses plan plnMessageUsr;
   #uses plan plnRequestGrpWho;
   #imports data blfHLA datHLA();
   #imports data blfUsers blfdatUsers();
}
//end capProcessData
```

The `evtGrpName` event represents a group name being sent to a Client in response to a request for a listing of current groups. The `name` is the group name instance carried.

```
// File: evtGrpName.event
package server;

/**
This event is an envelope for the name of a group that currently exist
in the chat network.
 */
public event
evtGrpName
   extends MessageEvent
{
   public String name;

   #posted as
   group(String name)
   {
      this.name = name;
   }
}
//end evtGrpName
```

The `evtGrpWhoRes` event represents a user name being sent to a Client in response to a request for a listing of those users sharing the current group. The `user` is the user name instance carried.

```
// File: evtGrpWhoRes.event
package server;

/**
This event is an envelope for the username retrieved by the GrpWhoPlan
plan.
 */
public event
evtGrpWhoRes
   extends MessageEvent
{
   public String user;

   #posted as
   result(String usr)
   {
      user = usr;
   }
}
//end evtGrpWhoRes
```

The evtJoinRes event represents the outcome of a user's request to join a Chat group. The group is the name of the group the user wished to join; the result is the Boolean outcome.

```
// File: evtJoinRes.event
package server;

/**
This event is an envelope for the data that is sent back to the Client
agent, from the server, as a result of the join group procedure. The
data stored in this event indicates the success or failure of the
procedure.
 */
public event
evtJoinRes
   extends MessageEvent
{
   public boolean result;
   public String group;

   #posted as
   result(String grp, boolean res)
   {
      group = grp;
      result = res;
   }
}
//end evtJoinRes
```

The `evtLeaveGrpRes` event represents the outcome of the user's request to leave a Chat group. The `group` is the name of the group the user wished to leave; the `result` is the Boolean outcome.

```
// File: evtLeaveGrpRes.event
package server;

/**
This event holds data which represents the success or failure of the
removal of a user from a specified group. It stores this information
in the form of a boolean to indicate the result and the name of the
group.
 */
public event
evtLeaveGrpRes
   extends MessageEvent
{
   public boolean result;
   public String group;

   #posted as
   result(boolean res, String grp)
   {
      result = res;
      group = grp;
   }
}
//end evtLeaveGrpRes
```

The evtLoginRes event represents the outcome of a user's request to log into the Chat federation. The status is the Boolean outcome; the location is the name of the JACK Client agent; the user is the user name.

```
// File: evtLoginRes.event
package server;

/**
This event is an envelope for the data that is sent back to the client
from the server, as a result of the login procedure.
 */
public event
evtLoginRes
   extends MessageEvent
{
   public boolean status;
   public String location;
   public String user;

   #posted as
   result(String username, String location, boolean logStatus)
   {
      user = username;
      this.location = location;
      status = logStatus;
   }
}
//end evtLoginRes
```

The evtMessageUsrRes event represents the outcome of a request to send a private message to some other user. The user is the target user name; the result is the Boolean outcome.

```
// File: evtMessageUsrRes.event
package server;

/**
This event holds data which indicates whether or not the message was
successfully sent to the user.
 */
public event
evtMessageUsrRes
   extends MessageEvent
{
   public boolean result;
   public String user;

   #posted as
   result(boolean status, String user)
   {
      this.result = status;
      this.user = user;
   }
}
//end evtMessageUsrRes
```

The `evtNoGrp` event is sent to the Client when it requests a listing of users for a non-existent chat group. The `group` is the name of the requested group.

```
// File: evtNoGrp.event
package server;

/**
This event is sent to the Client agent to indicate that no group
exists with that name.
 */
public event
evtNoGrp
   extends MessageEvent
{
   public String group;

   #posted as
   group(String grp)
   {
      group = grp;
   }
}
//end evtNoGrp
```

The `evtRelayMessg` event represents a message being relayed by the Server to the Client. Note that no distinction is made between public and private messages. The `messg` is the relayed message; the `fromUsr` is the originating user's name.

```
// File: evtRelayMessg.event
package server;

/**
This event is an envelope for the message being sent.
 */
public event
evtRelayMessg
   extends MessageEvent
{
   public String fromUsr;
   public String messg;

   #posted as
   relay(String msg, String user)
   {
      messg = msg;
      fromUsr = user;
   }
}
//end evtRelayMessg
```

The `evtHLA_AcquireChatRoomRegistry` event represents the sub-task of acquiring the ChatRoomRegistry. It is posted by the Server to itself. The `identifier` indicates which `HLAchat` is involved.

```
// File: evtHLA_AcquireChatRoomRegistry.event
package server;

/**
Occurs when a plan needs to subtask the acquisition of the
ChatRoomRegistry.
 */
public event
evtHLA_AcquireChatRoomRegistry
   extends Event
{
   public String identifier;

   #posted as
   create(String identifier)
   {
      this.identifier = identifier;
   }
}
//end evtHLA_AcquireChatRoomRegistry
```

The `evtHLA_ForceDivest` event represents the sub-task of aggressively divesting all of a federate's owned objects, as part of its log out procedure. It is posted by the Server to itself. The `identifier` indicates which `HLAchat` is involved.

```
// File: evtHLA_ForceDivest.event
package server;

/**
Occurs when a JACK client wants to shutdown and must therefore divest
itself of any owned objects.
 */
public event
evtHLA_ForceDivest
   extends Event
{
   public String identifier;

   #posted as
   create(String identifier)
   {
      this.identifier = identifier;
   }
}
//end evtHLA_ForceDivest
```

The evtHLA_ParticipantEntersGeneralChatRoom event represents the sub-task of entering the Participant object in the General ChatRoom, as part of the log in procedure. It is posted by the Server to itself. The identifier indicates which HLAchat is involved.

```
// File: evtHLA_ParticipantEntersGeneralChatRoom.event
package server;

/**
 * Handles the process of entering the (owned) Participant
 * into the General ChatRoom
 */
public event
evtHLA_ParticipantEntersGeneralChatRoom
   extends Event
{
   public String identifier;

   #posted as
   create(String identifier)
   {
      this.identifier = identifier;
   }
}
//end evtHLA_ParticipantEntersGeneralChatRoom
```

The `plnJoinGrp` plan handles the process of joining a chat group.

```
// File: plnJoinGrp.java
package server;

import hla.rti1516.*;
import client.evtJoinGrp;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
This plan handles the evtJoinGrp event, sent by the Client when it
wants to Join a Group (ChatRoom).
It initially checks whether or not the group specified already exists.
If the group exists then the user is added to the group.
Otherwise a new group is created and the user is added to it.
In both cases, to follow the HLA chat rules we combine the actual join
with a Leave Group.
 */
public plan
plnJoinGrp
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtJoinGrp ev;
   #posts event evtHLA_AcquireChatRoomRegistry
evHLA_AcquireChatRoomRegistry;
   #sends event evtJoinRes evJoinRes;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtJoinGrp ev)
   {
      return true;
   }

   context()
   {
       datHLA.get( ev.user, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }
   #reasoning method
   body()
   {
      //Because the viewKeyboard.processLine uses a StringTokenizer,
      //the ev.group String is guaranteed to be non-trivial
      //(not zero length, nor with leading or trailing blanks).
      //However, in the old JACK code, you could "Join" the default
      //ChatRoom ("General"); within the HLA chat rules, you cannot.
      //You use the Leave command for that.
      //Since the operation is essentially the same, we will change
      //the plnLeaveGrp so it simply posts an evtJoinGrp with
      //"_<General>" as the target.
      //We could implement this by either:
      // 1) Adding a boolean field to the evtJoinGrp so we can
distinguish between Join and Leave; or
      // 2) Exploiting the known characteristics of ev.group by
sending a zero-length ev.group.
      //We cannot do 1) because that would entail changing the
      //viewKeyboard in the client package.  Hence, we stipulate Leave
      //will post an evtJoinGrp with a zero-length ev.group

      //If joining the _<General> ChatRoom, no need to change
ChatRoomRegistry
      String                   _newChatRoomName;
      Server.HLAchat.aChatRoom _newChatRoom;
      //Whether the target ChatRoom existed already or not
      //(also used in the evtJoinRes fired back at the Client)
      boolean extantGroup;
      if ( ev.group.length() != 0 )
      {
         _newChatRoomName = "c" + ev.group;
         @wait_for( HLA._sem_theChatRooms.planWait() );
//       synchronized(_theChatRooms)
         {
            _newChatRoom = HLA.SeekChatRoomByName( _newChatRoomName );
         } //synchronized(_theChatRooms)
         HLA._sem_theChatRooms.signal();
         extantGroup = (null != _newChatRoom);
         //If not found, create it
         if (!extantGroup)
         {
            @subtask( evHLA_AcquireChatRoomRegistry.create( ev.user )
); //HLA.username
//          synchronized(HLA.AcquireChatRoomRegistry())
            {
               _newChatRoom =
HLA.AddChatRoomAndUpdateRegistry(ev.group);
//_newChatRoomName.substring(1)
            } //synchronized(AcquireChatRoomRegistry())
            HLA._sem_ChatRoomRegistry.signal();
         } //if
      } else {
         _newChatRoomName = HLA._name_general_ChatRoom;
         @wait_for( HLA._sem_theChatRooms.planWait() );
         _newChatRoom = HLA._general_ChatRoom =
HLA.SeekChatRoomBySlot( HLA._slot_general_ChatRoom );
         HLA._sem_theChatRooms.signal();
         extantGroup = (null != _newChatRoom);
         //If not found, create it
         if (!extantGroup)
         {
            @subtask( evHLA_AcquireChatRoomRegistry.create( ev.user )
); //HLA.username
//          synchronized(HLA.AcquireChatRoomRegistry())
            {
//             HLA._general_ChatRoom = HLA.new aChatRoom(
HLA._name_general_ChatRoom, HLA._slot_general_ChatRoom );
               HLA._general_ChatRoom = HLA.getNewChatRoom(
HLA._name_general_ChatRoom, HLA._slot_general_ChatRoom ); //Awaiting
bug fix
               HLA._general_ChatRoom.owned =
HLA._general_ChatRoom.subscribed = true;
//             HLA._general_ChatRoom.divesting = false;
               @wait_for( HLA._sem_theChatRooms.planWait() );
//             synchronized(_theChatRooms)
               {
                  HLA._theChatRooms.put( HLA._general_ChatRoom.handle
= HLA._rtiAmbassador.registerObjectInstance( HLA._och_ChatRoom),
HLA._general_ChatRoom );
                  //No need to add the General ChatRoom to the
_ChatRoomRegistry, as it is already listed
               } //synchronized(_theChatRooms)
               HLA._sem_theChatRooms.signal();
            } //synchronized(AcquireChatRoomRegistry())
            HLA._sem_ChatRoomRegistry.signal();
            _newChatRoom = HLA._general_ChatRoom;
         } //if
      } //if
      //At this point, _newChatRoom exists

      //Moving to the _newChatRoom
      //The change of ChatRooms cannot be from nowhere or
      //waiting_room; it has to be from an active ChatRoom, including
      //the "_<General>" ChatRoom.
      HLA._rtiAmbassador.unassociateRegionsForUpdates( HLA._me.handle,
HLA._asrspl_Participant_current );
      //At this point, _me.handle is only associated with
_asrspl_Participant_nowhere
```

```
      //Unsubscribe from the current ChatRoom
      HLA._rtiAmbassador.unsubscribeInteractionClassWithRegions(
HLA._ich_Communication, HLA._rhs_current_ChatRoom );
      //Look at the ChatRoom we're leaving to decide whether to delete
it or not
      int count = 0;
      @wait_for( HLA._sem_theParticipants.planWait() );
//    synchronized(_theParticipants)
      {
         Server.HLAchat.aParticipant _iParticipant;
         for (java.util.Iterator i =
HLA._theParticipants.values().iterator(); i.hasNext();)
         {
            _iParticipant = (Server.HLAchat.aParticipant)i.next();
            //Out of scope Participants have unreliable attributes;
they cannot be in our ChatRoom in any case
            //The only exceptions are owned Participants: any owned
orphans can only be in the waiting_room
            //_me isn't counted
            if ((!HLA._me.equals(_iParticipant.handle)) &&
                (_iParticipant.inscope) &&

(HLA._me.chat_room_slot.equals(_iParticipant.chat_room_slot)) )
count++;
         } //for
      } //synchronized(_theParticipants)
      HLA._sem_theParticipants.signal();

      //This'll cause the Participants in our ChatRoom to go out of
scope
      HLA._rtiAmbassador.unsubscribeObjectClassAttributesWithRegions(
HLA._och_Participant, HLA._asrspl_Participant_current );

      //What if someone logs into the ChatRoom after we've counted its
Participants but before we actually delete it?

      Server.HLAchat.aChatRoom _previousChatRoom = HLA._myChatRoom;
      HLA._myChatRoom = _newChatRoom;
      //Modify asrspl and delete old region, unless it was the General
ChatRoom
      RegionHandle _rh_previous_ChatRoom = HLA._rh_current_ChatRoom;
//= (RegionHandle)_rhs_current_ChatRoom.toArray()[0];
      HLA._asrspl_Participant_current.remove(0);
      HLA._rhs_current_ChatRoom.remove( _rh_previous_ChatRoom );
      if (!_rh_previous_ChatRoom.equals( HLA._rh_general_ChatRoom ))
      {
         HLA._rtiAmbassador.deleteRegion( _rh_previous_ChatRoom );
      } //if
      //New region
      if (_newChatRoomName.equals(HLA._name_general_ChatRoom))
      {
         HLA._rh_current_ChatRoom = HLA._rh_general_ChatRoom;
      } else {
         HLA._rh_current_ChatRoom = HLA._rtiAmbassador.createRegion(
HLA._dhs_ChatRoomSlotsSet );
         HLA._rtiAmbassador.setRangeBounds( HLA._rh_current_ChatRoom,
HLA._dh_ChatRoomSlots, new RangeBounds(
HLA._myChatRoom.slot.getValue(), 1 + HLA._myChatRoom.slot.getValue() )
);
      } //if
      HLA._rhs_current_ChatRoom.add( HLA._rh_current_ChatRoom );
      HLA._rtiAmbassador.commitRegionModifications(
HLA._rhs_current_ChatRoom ); //Won't complain if there are no mods to
commit
      //Regenerate asrspl
      HLA._asrspl_Participant_current.add( new
AttributeRegionAssociation( HLA._oahs_Participant_forUpdate,
HLA._rhs_current_ChatRoom ) );
      HLA._me.chat_room_slot.setValue( HLA._myChatRoom.slot.getValue()
);
      //Go back in
      //This'll reveal the participants in the new ChatRoom
      HLA._rtiAmbassador.subscribeObjectClassAttributesWithRegions(
HLA._och_Participant, HLA._asrspl_Participant_current );
      //Re-open the communication channel for the new ChatRoom
      HLA._rtiAmbassador.subscribeInteractionClassWithRegions(
HLA._ich_Communication, HLA._rhs_current_ChatRoom );
      //Reveal ourselves to the new ChatRoom
      HLA._rtiAmbassador.associateRegionsForUpdates( HLA._me.handle,
HLA._asrspl_Participant_current );
```

```
      //Delete old ChatRoom?
      if (count <= 0) //Should be just ==0 but you never know (because
of inscope, _me isn't counted)
      {
         //We were the only Participant left in the old ChatRoom;
delete it as we leave (we must be the owner, obviously)
         @subtask( evHLA_AcquireChatRoomRegistry.create( ev.user ) );
//HLA.username
//       synchronized(HLA.AcquireChatRoomRegistry())
         {
            //Because we're the owner, we won't get a
RemoveObjectInstance notification
            //The remove returns the removed value, which is
_previousChatRoom
            @wait_for( HLA._sem_theChatRooms.planWait() );
//          synchronized(_theChatRooms)
            {
               HLA._rtiAmbassador.deleteObjectInstance(
((Server.HLAchat.aChatRoom)HLA._theChatRooms.remove(
_previousChatRoom.handle ) ).handle, null );
            } //synchronized(_theChatRooms)
            HLA._sem_theChatRooms.signal();
            HLA.RemoveChatRoomAndUpdateRegistry(
_previousChatRoom.slot.getValue() );
         } //synchronized(AcquireChatRoomRegistry())
         HLA._sem_ChatRoomRegistry.signal();
      } else if (_previousChatRoom.owned) {
         //There are other Participants but we were the owner:
transfer ownership
         _previousChatRoom.divesting = true;
         HLA._rtiAmbassador.negotiatedAttributeOwnershipDivestiture(
_previousChatRoom.handle, HLA._oahs_ChatRoom, null );
      } //if
      // send an acknowledgement message event back to the user
      if (!_newChatRoomName.equals(HLA._name_general_ChatRoom))
   // if (!ev.group.equals(""))
      {
         @send( ev.from, evJoinRes.result( ev.group, extantGroup ) );
         System.err.println( "   (joining '" + ev.user + "' to group
'" + ev.group + "')" );
      }
      // When ev.group is "", this plan was invoked as a subtask of
plnLeaveGrp;
      // we must then defer to it to send the acknowledgement back
      // (since we've lost track of the ev.from)
   }
}
//end plnJoinGrp
```

The `plnLeaveGrp` **plan handles the overall process of removing a Client from its current group.**

```
// File: plnLeaveGrp.java
package server;

import client.evtJoinGrp;
import client.evtLeaveGrp;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
This plan handles the evtLeaveGrp event, sent by the Client when it
wants to Leave a Group (ChatRoom).
It removes the user from a specified group if the group exists.
It also removes the group from the network if that group is empty.
Because of the HLA chat rules, the Client will always Leave its
current group (because it can no longer belong to more than one
group).
 */
public plan
plnLeaveGrp
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtLeaveGrp ev;
   #posts event evtJoinGrp evJoinGrp;
   #sends event evtJoinRes evJoinRes;
   #sends event evtLeaveGrpRes evLeaveGrpRes;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtLeaveGrp ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.user, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }
   #reasoning method
   body()
   {
      //We re-use the plnJoinGrp by sub-tasking
      //See if Leaving correct group (the current one)
      if (HLA._myChatRoom.name.toString().substring(1).equals(
ev.group ))
      {
         //Yes (treat as Joining the _<General> ChatRoom)
         @subtask( evJoinGrp.join( "", ev.user) );
         @send( ev.from, evLeaveGrpRes.result( true, ev.group ) );
         System.out.println( "    (removing '" + ev.user + "' from
group '" + ev.group + "')" );
         @send( ev.from, evJoinRes.result( "<General>", true ) );
         System.out.println( "    (joining '" + ev.user + "' to group
'<General>')" );
      } else {
         //No
         @send( ev.from, evLeaveGrpRes.result( false, ev.group ) );
         System.err.println( "    (group '" + ev.group + "' incorrect)"
);
      } //if
   }
}
//end plnLeaveGrp
```

The `plnListGrp` plan handles the overall process of giving the Client a list of all current groups.

```
// File: plnListGrp.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import client.evtListGrp;

/**
This plan handles the evtListGrp event, which occurs when the Client
sends the "group" command.
Originally, it posted an Inference Goal Event (evtListGrpIGE) to
retrieve all group names from blfdatGrpList.
 */
public plan
plnListGrp
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtListGrp ev;
   #sends event evtGrpName evGrpName;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtListGrp ev)
   {
      return true;
   }

   context()
   {
      //Where most other events sent by the Client specify the
username
      //(in the ev.user field, filled from ((Client)
self).getUserName()),
      //this evtListGrp does not.  Luckily, we can recover it
      //from the ev.from, which will be of the form
"username@portalname".
      datHLA.get( ev.from.substring(0, ev.from.indexOf("@")), _HLA )
&&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      System.out.println( "   (retrieving group names)" );
      @wait_for( HLA._sem_theChatRooms.planWait() );
      {
         for (java.util.Iterator i =
HLA._theChatRooms.values().iterator(); i.hasNext(); )
         {
            Server.HLAchat.aChatRoom _ChatRoom =
(Server.HLAchat.aChatRoom)i.next();
            //Skip _waiting_room
            if (!_ChatRoom.name.toString().equals(
HLA._name_waiting_room_ChatRoom ))
            {
               //Report General room differently
               if (_ChatRoom.name.equals( HLA._name_general_ChatRoom
))
               {
                  @send( ev.from, evGrpName.group( "General" ) );
               } else {
                  @send( ev.from, evGrpName.group(
_ChatRoom.name.toString().substring(1) ) );
               }
               System.out.println( "   (reporting group '" +
_ChatRoom.name.toString() + "')" );
            }
         } //for
      } //synchronized (_theChatRooms)
      HLA._sem_theChatRooms.signal();
   }
}
//end plnListGrp
```

The plnLoginUser plan handles the delicate process of logging a user in.

```
// File: plnLoginUser.java
package server;

import java.io.*;
import java.util.StringTokenizer;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import client.evtUserLogin;

/**
This plan is responsible for adding a new user to the chat network.
It only adds the user if there is no user currently logged on with the
specified username.
 */
public plan
plnLoginUser
   extends Plan
{
   BufferedReader buf;
   #handles event evtUserLogin ev;
   #posts event evtHLA_ForceDivest evHLA_ForceDivest;
   #sends event evtLoginRes evLoginRes;
   #uses interface Server server;
   #uses data blfHLA datHLA;
   #uses data blfUsers blfdatUsers;

   static boolean relevant(evtUserLogin ev)
   {
      return true;
   }

   context()
   {
       true;
   }
   #reasoning method
   body()
   {
      /* If another Client was created on the same host machine
         at the same time (to within 1 ms), it'll have the same
         portal name (ev.from) (see StartClient to see why).
         We could detect this rare occurrence but there's nothing we
         could do about it since any messages fired back at that
         portal would have only a 50% chance of reaching the right
         agent.  This could be improved by using the username as a
         discriminator, but what if they *also* try to log in
         under the same name?
       */
      /**
       * In the original code, the plan skipped straight to a
       * vewdatUserData.addUser query, which decided whether or
       * not the login was successful.
       * With HLA, things are more complicated, so we must
       * do things at the plan level before querying any
       * Views or Belief Sets.
       */
     System.out.println( "Logging user in as '" + ev.username + "'" );

      //Create the HLAchat instance for the client
      Server.HLAchat HLA;
      try {
//       HLA = server.new HLAchat(ev.username);
         HLA = server.newHLAchat(ev.username);
      } catch (aos.jack.jak.beliefset.BeliefSetException e) {
         // Send a MessageEvent back to the client to indicate that
         // the login procedure was a failure.
         @send( ev.from, evLoginRes.result( ev.username, ev.from,
false ) );
         System.err.println( "Couldn't log user in. HLA RTI connection
failed or username already logged in." );
         return true; //Plan succeeds (but login fails)
      }

      System.out.println( " HLA federate created" );
      //HLAchat's constructor joins the federation and obtains the
      //various handles; it sets up its generic FederateAmbassador
      //callbacks and creates the ChatRoomRegistry Java object but
      //does not publish/subscribe anything.
      //
      //Note that if HLA isn't stored it'll go out of scope once this
      //plan concludes and will be garbage-collected.  Its finalize()
      // method invokes disconnect() if it made it as far as joining
      //the federation.
      if (HLA.connected)
      {
         //We don't need to store a reference to the Server.HLAchat
         //instance because its constructor stores itself (at the
         //HLA1516.capHLA1516.HLAfederate level) in datHLA (and the
         //class of the stored instance is indeed HLAchat)
         //Publish/Subscribe the interaction
         HLA._rtiAmbassador.publishInteractionClass(
HLA._ich_Communication );
         HLA._rtiAmbassador.subscribeInteractionClassWithRegions(
HLA._ich_Communication, HLA._rhs_waiting_room_ChatRoom );
         //By subscribing through the waiting room only, we only
         //trigger the advisories, without risking to get any
         //Communications (because the waiting room is not a valid
         //Communication "target").
         //Note that at this point the waiting room ChatRoom may not
         //exist yet.

         //Set up ChatRoomRegistry, creating the HLA object if
necessary
         HLA._rtiAmbassador.publishObjectClassAttributes(
HLA._och_ChatRoomRegistry, HLA._oahs_ChatRoomRegistry_forUpdate );
         // Reserve name
         HLA.sem_name_reservation.clearChanged();
         //We must create the semaphore before calling
         //reserveObjectInstanceName in the (unlikely) case that the
         //nameReservationOutcome callback occurs before this task
         //reaches the wait_for statement.
         //With a single-threaded Agent, this cannot occur anyway.
         System.out.println( "Looking up Chat Room Registry..." );
         HLA._rtiAmbassador.reserveObjectInstanceName(
HLA._ChatRoomRegistry.name );
         //Wait for reservation succeeded/failed
         //The name reservation handler for ChatRoomRegistry takes
         //care of creating the ChatRoomRegistry (if the reservation
         //was successfull) or of waiting for its discovery (if not)
         //The flag takes care of the case where the callback occurs
before we reach the wait_for
         @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_name_reservation, HLA.sem_name_reservation.hasChanged() ) );
         //Assert: At this point, HLA._ChatRoomRegistry is known

         //Set up ChatRooms, creating the _waiting_room HLA object if
necessary
         HLA._rtiAmbassador.publishObjectClassAttributes(
HLA._och_ChatRoom, HLA._oahs_ChatRoom_forUpdate );
         // Reserve _waiting_room name
         HLA.sem_name_reservation.clearChanged(); //Alternative to  =
new MyObservable();
         HLA._rtiAmbassador.reserveObjectInstanceName(
HLA._name_waiting_room_ChatRoom );
         //Wait for reservation succeeded/failed
         //The flag takes care of the case where the callback occurs
before we reach the wait_for
         System.out.println( "Looking up Waiting Room..." );
         @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_name_reservation, HLA.sem_name_reservation.hasChanged() ) );
         //Assert: At this point, HLA._waiting_room_ChatRoom is known
         //There is a small chance that the waiting room's attributes
have
         //not been updated yet, but that should sort itself out
pretty quickly.
```

```
         //Setup Participants
         HLA._rtiAmbassador.publishObjectClassAttributes(
HLA._och_Participant, HLA._oahs_Participant_forUpdate );
         //Note that associateRegionsForUpdates can be done only on a
per-instance basis
         //We publish federation-wide but will update and subscribe
through DDM
         //No federate *ever* subscribes to the nowhere "ChatRoom"
         HLA._rtiAmbassador.subscribeObjectClassAttributesWithRegions(
HLA._och_Participant, HLA._asrspl_Participant_waiting_room );

         //Log in proper
         HLA._me_logging_in = true;
         HLA._me.name.setValue( "p" + ev.username ); //HLA.username );
//       HLA._me.handle = null; //ObjectInstanceHandle of the
Participant object
//       HLA._me.user_handle.setValue(0); //Same value, as an HLAint32
for DDM purposes
         // Reserve username
         HLA.sem_name_reservation.clearChanged(); //Alternative to  =
new MyObservable();
         HLA._rtiAmbassador.reserveObjectInstanceName(
HLA._me.name.toString() );
         // Wait for reservation succeeded/failed
         System.out.println( "Looking up '" + ev.username + "'..." );
//HLA.username
         @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_name_reservation, HLA.sem_name_reservation.hasChanged() ) );

         if (HLA._me_logged_in)
         {
            HLA._rtiAmbassador.subscribeInteractionClassWithRegions(
HLA._ich_Communication, HLA._rhs_current_ChatRoom );
            HLA._rtiAmbassador.subscribeInteractionClassWithRegions(
HLA._ich_Communication, HLA._rhs_myParticipantRegion );
         } else {
            //Log in failed, remove ourselves from belief set
            datHLA.remove( ev.username, HLA );
         } //if
      } //if
      if (!HLA.connected)
      {
         //If the constructor succeeded, ev.username has been
registered, even if the connection later failed
         datHLA.remove( ev.username, HLA );
         // Send a MessageEvent back to the client to indicate that
         // the login procedure was a failure.
         @send( ev.from, evLoginRes.result( ev.username, ev.from,
false ) );
         System.err.println( "Couldn't log user in. HLA RTI connection
failed." );
      } else if (!HLA._me_logged_in) {
         @send( ev.from, evLoginRes.result( ev.username, ev.from,
false ) );
         System.err.println( "Couldn't log user in. Username already
exists." );
         //Must disconnect now
         HLA._me_shutting_down = true;
         HLA.doUnsubscribe();
         @subtask( evHLA_ForceDivest.create( ev.username ) );
         HLA.doUnpublish();
         HLA.resignFederationExecution();
         //Garbage collector should deal with HLA now
         System.gc();
      } else {
         // Add new user to the Users beliefset
         // CAREFUL: Sorting the fields of a beliefset changes
         // the sequence of parameters in the add/remove methods!
         blfdatUsers.add( ev.from, ev.username );
         System.out.println("Added '" + ev.username + "' to Users
belief set.");
         // Send a MessageEvent back to the client to indicate that
         // the login procedure was a success.
         @send( ev.from, evLoginRes.result( ev.username, ev.from, true
) );
         System.out.println( "User successfully logged in." );
      } //if
   }
}
//end plnLoginUser
```

The `plnLogoutUsr` plan handles the process of logging a user out.

```
// File: plnLogoutUsr.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import client.evtLogout;

/**
This plan handles the evtLogout event which occurs when the Client
logs out.
After the considerable HLA clean up, it removes the username from the
Users (and datHLA) belief set(s).
 */
public plan
plnLogoutUsr
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtLogout ev;
   #posts event evtHLA_AcquireChatRoomRegistry
evHLA_AcquireChatRoomRegistry;
   #posts event evtHLA_ForceDivest evHLA_ForceDivest;
   #uses interface Server server;
   #uses data blfHLA datHLA;
   #uses data blfUsers blfdatUsers;

   static boolean relevant(evtLogout ev)
   {
      return true;
   }

   context()
   {
     datHLA.get( ev.user, _HLA ) &&
     ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      //Log out procedure
      System.out.println("HLAchat shutting down...");
      HLA._me_shutting_down = true;
      HLA._me_logged_in = false;
      //Move from "current" ChatRoom to "waiting_room" ChatRoom
      //Unsubscribe from the current ChatRoom

HLA._rtiAmbassador.unsubscribeInteractionClassWithRegions(HLA._ich_Com
munication, HLA._rhs_current_ChatRoom);
      //Unsubscribe from the user handle channel

HLA._rtiAmbassador.unsubscribeInteractionClassWithRegions(HLA._ich_Com
munication, HLA._rhs_myParticipantRegion);
```

```
      //Look at the ChatRoom we're leaving to decide whether to delete
it or not
      int count = 0;
      @wait_for( HLA._sem_theParticipants.planWait() );
      {
         Server.HLAchat.aParticipant _iParticipant;
         for ( java.util.Iterator i =
HLA._theParticipants.values().iterator(); i.hasNext();)
         {
            _iParticipant = (Server.HLAchat.aParticipant)i.next();
            //Out of scope Participants have unreliable attributes;
they cannot be in our ChatRoom in any case
            //The only exceptions are owned Participants: any owned
orphans can only be in the waiting_room
            //_me isn't counted
            if ( ( !HLA._me.handle.equals(_iParticipant.handle) ) &&
                 ( _iParticipant.inscope ) &&
                 ( HLA._me.chat_room_slot.equals(
_iParticipant.chat_room_slot ) ) ) count++;
         }
      } //synchronized(_theParticipants)
      HLA._sem_theParticipants.signal();

      //This'll cause the Participants in our ChatRoom to go out of
scope
      HLA._rtiAmbassador.unsubscribeObjectClassAttributesWithRegions(
HLA._och_Participant, HLA._asrspl_Participant_current );

      //What if someone logs into the ChatRoom after we've counted its
Participants but before we actually delete it?

      //Doesn't seem worth synchronizing on _myChatRoom
      if (count <= 0) //Should be just ==0 but you never know (because
of inscope, _me isn't counted)
      {
         //We were the only Participant left in the ChatRoom; delete
it as we leave (we must be the owner, obviously)
         @subtask( evHLA_AcquireChatRoomRegistry.create( ev.user ) );
//HLA.username
         {
//          HLA._theChatRooms.remove( HLA._myChatRoom.handle );
//Because we're the owner, we won't get a RemoveObjectInstance
notification
//          HLA._rtiAmbassador.deleteObjectInstance(
HLA._myChatRoom.handle, null );
            //Because we're the owner, we won't get a
RemoveObjectInstance notification
            //The remove returns the removed value, which is
_myChatRoom
            HLA._rtiAmbassador.deleteObjectInstance( (
(Server.HLAchat.aChatRoom)HLA._theChatRooms.remove(
HLA._myChatRoom.handle ) ).handle, null );
            HLA.RemoveChatRoomAndUpdateRegistry(
HLA._myChatRoom.slot.getValue() );
         } //synchronized(AcquireChatRoomRegistry())
         HLA._sem_ChatRoomRegistry.signal();
      }
```

```
/**
      This is now done in doForceDivest:
      else if (HLA._myChatRoom.owned)
      {
         //There are other Participants but we were the owner:
transfer ownership
         HLA._myChatRoom.divesting = true;
         HLA._rtiAmbassador.negotiatedAttributeOwnershipDivestiture(
HLA._myChatRoom.handle, HLA._oahs_ChatRoom, null );
      }
 */
      HLA._myChatRoom = null;

      //The _me Participant is the only one that can be elsewhere than
the waiting_room and be owned;
      //by definition, an owned Participant stands in for the federate
in whichever ChatRoom it is
      //Move it from current to waiting_room
      HLA._rtiAmbassador.unassociateRegionsForUpdates( HLA._me.handle,
HLA._asrspl_Participant_current );
      @wait_for( HLA._sem_me.planWait() );
      {
         HLA._me.logged_in.setBoolean(false);
         HLA._me.chat_room_slot.setValue(
HLA._slot_waiting_room_ChatRoom );
         HLA._rtiAmbassador.associateRegionsForUpdates(
HLA._me.handle, HLA._asrspl_Participant_waiting_room );
         //AutoProvide will fetch our attribute update (since all
federates subscribe to the waiting_room ChatRoom at all times)
      } //synchronized(_me)
      HLA._sem_me.signal();
      HLA._me = HLA.getNewParticipant();
//    HLA._me = HLA.new aParticipant(); //awaiting bug fix

      //Delete the now unused regions
      HLA._rhs_myParticipantRegion.remove( HLA._rh_myParticipantRegion
);
      HLA._rtiAmbassador.deleteRegion( HLA._rh_myParticipantRegion );
      HLA._rh_myParticipantRegion = null;
      HLA._rhs_myParticipantRegion = null;
      if ( !HLA._rh_current_ChatRoom.equals(HLA._rh_general_ChatRoom)
)
      {
         HLA._rtiAmbassador.deleteRegion( HLA._rh_current_ChatRoom );
         HLA._rh_current_ChatRoom = null;
      }

      //Here begins the exitForm equivalent
      HLA.doUnsubscribe();
      @subtask( evHLA_ForceDivest.create( ev.user ) ); //or
HLA.username
      HLA.doUnpublish();
      HLA.resignFederationExecution();
      //Remove ourselves from datHLA
      System.out.println("Logging '" + ev.user + "' out.");
      datHLA.remove( ev.user, HLA );
      // Remove user from the Users beliefset.
      logical String location;
      blfdatUsers.get( location, ev.user );
      blfdatUsers.remove( location.as_string(), ev.user );
      System.out.println( "Logged user '" + ev.user + "' out." );
      //Garbage collector should deal with HLA now
      System.gc();
   }
}
//end plnLogoutUsr
```

The `plnMessageGrp` plan handles the sending of a message to the current group.

```
// File: plnMessageGrp.java
package server;

import client.evtMessageGrp;
import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;

/**
This plan handles the evtMessageGrp, which occurs when a Client sends
"msg" to its current group.
Like plnRequestGrpWho, the original design posted an Inference Goal
Event to unify over the various usernames associated to the current
group.
Here we simply send the HLA interaction.
 */
public plan
plnMessageGrp
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtMessageGrp ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtMessageGrp ev)
   {
      return true;
   }

   context()
   {
       datHLA.get( ev.fromUsr, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }
   #reasoning method
   body()
   {
//     @post( msgGrpIGE.message( ev.group, ev.messg, ev.from,
ev.fromUsr ) );
      System.out.println( "    (sending message to group '" + ev.group
+ "')" );
      //The message could be the zero-length String
      HLAunicodeString us_cmdline = new HLAunicodeString(ev.messg);
      //Note that there is no such thing as a ParameterHandleSet
      ParameterHandleValueMap _phvm_parameters =
HLA._rtiAmbassador.getParameterHandleValueMapFactory().create(2);
      _phvm_parameters.put( HLA._iph_Communication_message,
us_cmdline.toByteArray() );
      _phvm_parameters.put( HLA._iph_Communication_sender,
HLA._me.name.toByteArray() );
      HLA._rtiAmbassador.sendInteractionWithRegions(
HLA._ich_Communication, _phvm_parameters, HLA._rhs_current_ChatRoom,
null );
   }
}
//end plnMessageGrp
```

The `plnMessageUsr` plan handles the sending of a message to a specific user.

```
// File: plnMessageUsr.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;
import client.evtMessageUsr;

/**
This plan handles the evtMessageUsr event, which occurs when the
Client uses "msgusr" to send a message to a specific user.
If the target user is not within the same ChatRoom, then a
MessageUsrRes with false as the field value for 'result' will be sent
back to the sending user.
This is because the HLA rules restrict private messaging to within the
current ChatRoom.
 */
public plan
plnMessageUsr
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtMessageUsr ev;
   #sends event evtMessageUsrRes evMessageUsrRes;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtMessageUsr ev)
   {
      return true;
   }

   context()
   {
       datHLA.get( ev.fromUsr, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      //The message could be the zero-length String
      HLAunicodeString us_cmdline = new HLAunicodeString(ev.messg);
      //Note that there is no such thing as a ParameterHandleSet
      ParameterHandleValueMap _phvm_parameters =
HLA._rtiAmbassador.getParameterHandleValueMapFactory().create(2);
      _phvm_parameters.put( HLA._iph_Communication_message,
us_cmdline.toByteArray() );
      _phvm_parameters.put( HLA._iph_Communication_sender,
HLA._me.name.toByteArray() );

      //We'll use DDM to send the message to a single user (within the
same chat room)
      //The Participant object has three attributes, all three of
which are bound
      //to the ChatRoomSlots dimension; in addition, user_handle is
bound to UserHandleSlots.

      //To allow user names and chat room names to be anything, the
latter will be prefixed
      //by "p" and "c", respectively, whilst our reserved names will
be prefixed by "_"
      HLAunicodeString _us_TargetName = new HLAunicodeString("p" +
ev.toUsr);
      @wait_for( HLA._sem_theParticipants.planWait() );
//    synchronized(_theParticipants)
      {
         //Target may or may not be known or even extant, since the
Client can specify any ID
//       ObjectInstanceHandle key =
HLA._rtiAmbassador.getObjectInstanceHandle( "p" + ev.toUsr );
         Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipantByName( _us_TargetName.toString() );
         //_me is usually not in scope (being owned), so you cannot
talk to yourself
```

```
         if ((_Participant == null) || (!_Participant.inscope) ||
(!_Participant.logged_in.getBoolean()))
         {
            @send( ev.from, evMessageUsrRes.result( false, ev.toUsr )
);
            System.err.println( "   (target user '" + ev.toUsr + "'
not found)" );
            HLA._sem_theParticipants.signal();
            return true;
         }

         //The _ich_Communication interaction has two dimensions:
UserHandleSlots and ChatRoomSlots
         RegionHandle _rh_aParticipant =
HLA._rtiAmbassador.createRegion( HLA._dhs_UserHandleSlotsSet );
         HLA._rtiAmbassador.setRangeBounds( _rh_aParticipant,
HLA._dh_UserHandleSlots, new RangeBounds(
_Participant.user_handle.getValue(),
_Participant.user_handle.getValue() + 1 ) );
         RegionHandleSet _rhs_aParticipant =
HLA._rtiAmbassador.getRegionHandleSetFactory().create();
         _rhs_aParticipant.add(_rh_aParticipant);
         HLA._rtiAmbassador.commitRegionModifications(
_rhs_aParticipant );
         HLA._rtiAmbassador.sendInteractionWithRegions(
HLA._ich_Communication, _phvm_parameters, _rhs_aParticipant, null );
         //Now throw the region away
         _rhs_aParticipant.remove( _rh_aParticipant );
         HLA._rtiAmbassador.deleteRegion( _rh_aParticipant );
      } //synchronized(_theParticipants)
      HLA._sem_theParticipants.signal();
      // Send an acknowledgement message back to the sending user.
      @send( ev.from, evMessageUsrRes.result(true, ev.toUsr) );
      System.out.println( "   (sending message to '" + ev.toUsr + "')"
);
   }
}
//end plnMessageUsr
```

The `plnRequestGrpWho` plan handles a Client request for a list of other users within the same group.

```
// File: plnRequestGrpWho.java
package server;

import client.evtRequestGrpWho;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
This plan handles the evtRequestGrpWho, which occurs when a Client
asks "who" belongs to a given Group (could be its current one).
It checks whether the group exists (is known); if it does, in the
original design it posts an evtGrpWhoIGE; if it does not, it sends
back an evtNoGrp.
Since evtGrpWhoIGE is an Inference Goal Event, it runs all applicable
instances of Plans; the plnGrpWho then used its context() to unify
over all usernames found associated with the requested group.
This rather clever use of an IGE is not applicable here, so we do away
with the event and plan altogether (We can do this because they are
internal to server). We only keep the original's outcome, the series
of evtGrpWhoRes events it sends back to the Client.
 */
public plan
plnRequestGrpWho
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtRequestGrpWho ev;
   #sends event evtGrpWhoRes evGrpWhoRes;
   #sends event evtNoGrp evNoGrp;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtRequestGrpWho ev)
   {
      return true;
   }
   context()
   {
       //Where the other events sent by the Client specify the
username
       //(in the ev.user field, filled from ((Client)
self).getUserName()),
       //this evtRequestGrpWho does not.  Luckily, we can recover it
       //from the ev.from, which will be of the form
"username@portalname".
//     datHLA.get( ev.owner, _HLA ) &&
//     server.println( Thread.currentThread() + "
plnRequestGrpWho.context: username is <" + ev.from.substring(0,
ev.from.indexOf("@")) + ">" ) &&
       datHLA.get( ev.from.substring(0, ev.from.indexOf("@")), _HLA )
&&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      Server.HLAchat.aChatRoom _ChatRoom;
      @wait_for( HLA._sem_theChatRooms.planWait() );
      {
         //The Client will ask for "General" when it means
"_<General>"
         //(it is allowed to "Join General", which creates
"cGeneral");
         //the local name will hide the global.
         _ChatRoom = HLA.SeekChatRoomByName("c" + ev.group);
      }
      HLA._sem_theChatRooms.signal();
      if ((_ChatRoom == null) && (ev.group.equals("General")))
_ChatRoom = HLA._general_ChatRoom;
```

```
      if (_ChatRoom != null)
      {
         // group does exist
         //Original design was:
//       @post( evGrpWhoIGE.who( ev.group, ev.from ) );
//       System.out.println( "   (retrieving members of group '" +
ev.group + "')" );
         @wait_for( HLA._sem_theParticipants.planWait() );
         {
            for (java.util.Iterator i =
HLA._theParticipants.values().iterator(); i.hasNext(); )
            {
               Server.HLAchat.aParticipant _Participant =
(Server.HLAchat.aParticipant)i.next();
               //_me is filtered out because it is not in scope (being
owned)
               if (_Participant.inscope &&
_Participant.chat_room_slot.equals( _ChatRoom.slot ))
               {
                  @send( ev.from, evGrpWhoRes.result(
_Participant.name.toString().substring(1) ) );
                  System.out.println( "   (reporting group member '" +
_Participant.name.toString() + "')" );
               } //if
            } //for
            //Add _me
            if (HLA._me.chat_room_slot.equals( _ChatRoom.slot ))
            {
               // HLA.username is:
               //ev.from.substring(0, ev.from.indexOf("@"))
               // or equivalently
               //HLA._me.name.toString().substring(1)
               @send( ev.from, evGrpWhoRes.result(
HLA._me.name.toString().substring(1) ) );
//             System.out.println( "   (reporting group member 'p" +
HLA._me.name.toString().substring(1) + "')" ); //HLA.username
               System.out.println( "   (reporting group member '" +
HLA._me.name + "')" );
            }
         } //synchronized(_theParticipants)
         HLA._sem_theParticipants.signal();
      } else {
         // group doesn't exist
         @send( ev.from, evNoGrp.group( ev.group ) );
         System.err.println( "   (group '" + ev.group + "' not
extant)" );
      } //if
   }
}
//end plnRequestGrpWho
```

The `plnHLA_AcquireChatRoomRegistry` plan handles the (frequent) sub-task of securing ownership of the ChatRoomRegistry.

```
// File: plnHLA_AcquireChatRoomRegistry.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
This subtask takes care of acquiring the ChatRoomRegistry for a
specific HLAchat instance.  It is meant to be called as a @subtask()
 */
public plan
plnHLA_AcquireChatRoomRegistry
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLA_AcquireChatRoomRegistry ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLA_AcquireChatRoomRegistry ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      @wait_for( HLA._sem_ChatRoomRegistry.planWait() );
      //Presumably the Semaphore will remain grabbed by this thread
      //and will therefore pass from this plan to the invoking one
      if (HLA._ChatRoomRegistry.owned) return true;
      HLA.sem_ChatRoomRegistry_acquisition.clearChanged();
      HLA._rtiAmbassador.attributeOwnershipAcquisition(
HLA._ChatRoomRegistry.handle, HLA._oahs_ChatRoomRegistry, null );
      @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_ChatRoomRegistry_acquisition,
HLA.sem_ChatRoomRegistry_acquisition.hasChanged() ) );
      //Failure to acquire is not an option
   }
}
//end plnHLA_AcquireChatRoomRegistry
```

The `plnHLA_ForceDivest` plan handles the sub-task of aggressively divesting ownership of any still-owned objects, in order to complete a Client's withdrawal from the Chat federation.

```
// File: plnHLA_ForceDivest.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
This subtask takes care of divesting any owned objects during
shutdown.  It is meant to be called as a @subtask()
 */
public plan
plnHLA_ForceDivest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLA_ForceDivest ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLA_ForceDivest ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   divestChatRoomRegistry()
   {
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      if (!HLA._ChatRoomRegistry.owned) return true;
      HLA.sem_ChatRoomRegistry_divestiture.clearChanged();
      HLA._ChatRoomRegistry.divesting = true;
      HLA._rtiAmbassador.negotiatedAttributeOwnershipDivestiture(
HLA._ChatRoomRegistry.handle, HLA._oahs_ChatRoomRegistry, null );
      @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_ChatRoomRegistry_divestiture,
HLA.sem_ChatRoomRegistry_divestiture.hasChanged() ) );
      //Other federates will receive
requestAttributeOwnershipAssumption and
      //respond with attributeOwnershipAcquisitionIfAvailable.
      //We'll get requestDivestitureConfirmation, to which we'll
confirmDivestiture
      //Once that is done, we no longer own _ChatRoomRegistry and can
resign normally.
   } //divestChatRoomRegistry
   #reasoning method
   divestChatRooms()
   {
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      //Any federate callbacks requesting ownership assumption will be
turned down right away;
      //however, ownership acquisition notifications could conceivably
squeak through
      //(if another federate started shutting down just before this
one does) and would lock
      //up on the synchronized(_theChatRooms), so we take a snapshot
and release the monitor right away.
      Server.HLAchat.aChatRoom[] _ChatRooms;
      @wait_for( HLA._sem_theChatRooms.planWait() );
      {
         _ChatRooms = (Server.HLAchat.aChatRoom[])
HLA._theChatRooms.values().toArray( new Server.HLAchat.aChatRoom[0] );
      } //synchronized(_theChatRooms)
      HLA._sem_theChatRooms.signal();
//    for (Iterator i = HLA._theChatRooms.entrySet().iterator();
i.hasNext();)
      for (int i = 0; i < _ChatRooms.length; i++)
      {
//       _ChatRoom = (Server.HLAchat.aChatRoom)(
(java.util.Map.Entry)i.next() ).getValue();
         Server.HLAchat.aChatRoom _ChatRoom = _ChatRooms[i];
         if (_ChatRoom.owned)
         {
            HLA.sem_ChatRoom_divestiture.clearChanged();
            _ChatRoom.divesting = true;

HLA._rtiAmbassador.negotiatedAttributeOwnershipDivestiture(
_ChatRoom.handle, HLA._oahs_ChatRoom, null );
            @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_ChatRoom_divestiture,
HLA.sem_ChatRoom_divestiture.hasChanged() ) );
         } //if
      } //for
   } //divestChatRooms
   #reasoning method
   divestParticipants()
   {
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      //Any federate callbacks requesting ownership assumption will be
turned down right away;
      //however, ownership acquisition notifications could conceivably
squeak through
      //(if another federate started shutting down just before this
one does) and would lock
      //up on the synchronized(_theParticipants), so we take a
snapshot and release the monitor right away.
      Server.HLAchat.aParticipant[] _Participants;
      @wait_for( HLA._sem_theParticipants.planWait() );
      {
         _Participants = (Server.HLAchat.aParticipant[])
HLA._theParticipants.values().toArray( new
Server.HLAchat.aParticipant[0] );
      } //synchronized(_theParticipants)
      HLA._sem_theParticipants.signal();
//    for (Iterator i = HLA._theParticipants.entrySet().iterator();
i.hasNext();)
      for (int i = 0; i < _Participants.length; i++)
      {
//       _Participant = (Server.HLAchat.aParticipant)(
(java.util.Map.Entry)i.next() ).getValue();
         Server.HLAchat.aParticipant _Participant = _Participants[i];
         if (_Participant.owned)
         {
            HLA.sem_Participant_divestiture.clearChanged();
            _Participant.divesting = true;

HLA._rtiAmbassador.negotiatedAttributeOwnershipDivestiture(
_Participant.handle, HLA._oahs_Participant, null );
            @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_Participant_divestiture,
HLA.sem_Participant_divestiture.hasChanged() ) );
         } //if
      } //for
   } //divestParticipants

   #reasoning method
   body()
   {
      //No action required if last federate out
      if (HLA._alone) return true;
      //This method is invoked when the federate wants to shut down
but still owns some instance attributes
      //ChatRoomRegistry object
      divestChatRoomRegistry();
      //ChatRoom objects
      divestChatRooms();
      //Participant objects
      divestParticipants();
   }
}
//end plnHLA_ForceDivest
```

The `plnHLA_ChatRoomRegistry_Discovery` plan handles the discovery of the ChatRoomRegistry object.

```
// File: plnHLA_ChatRoomRegistry_Discovery.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAdiscoverObjectInstance;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles HLA ChatRoomRegistry Discovery
 */
public plan
plnHLA_ChatRoomRegistry_Discovery
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAdiscoverObjectInstance ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAdiscoverObjectInstance ev)
   {
      return ev.objectName.equals(
Server.HLAchat._name_ChatRoomRegistry );
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      ev.theObjectClass.equals( HLA._och_ChatRoomRegistry );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      HLA._ChatRoomRegistry.handle = ev.theObject;
      //Signal the waiting plnHLA_ChatRoomRegistryNameReservation that
we're done
      HLA.sem_ChatRoomRegistry_discovery.setChanged();
   }
}
//end plnHLA_ChatRoomRegistry_Discovery
```

The `plnHLA_ChatRoomRegistry_NameReservation_Failed` **plan handles the failed outcome of the ChatRoomRegistry name reservation.**

```
// File: plnHLA_ChatRoomRegistry_NameReservation_Failed.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationFa
iled;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the evtHLAobjectInstanceNameReservationFailed for
ChatRoomRegistry
 */
public plan
plnHLA_ChatRoomRegistry_NameReservation_Failed
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAobjectInstanceNameReservationFailed ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAobjectInstanceNameReservationFailed
ev)
   {
      return
ev.objectName.equals(Server.HLAchat._name_ChatRoomRegistry);
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      //Name reservation failed, which means there is an already
extant instance
      HLA.sem_ChatRoomRegistry_discovery.clearChanged();
      HLA._ChatRoomRegistry.subscribed = true;
      HLA._rtiAmbassador.subscribeObjectClassAttributes(
HLA._och_ChatRoomRegistry, HLA._oahs_ChatRoomRegistry_forUpdate );
      @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_ChatRoomRegistry_discovery,
HLA.sem_ChatRoomRegistry_discovery.hasChanged() ) );
      //Signal the waiting plnLoginUser that we're done
      HLA.sem_name_reservation.setChanged();
   }
}
//end plnHLA_ChatRoomRegistry_NameReservation_Failed
```

The `plnHLA_ChatRoomRegistry_NameReservation_Succeeded` plan handles the successful outcome of the ChatRoomRegistry name reservation.

```
// File: plnHLA_ChatRoomRegistry_NameReservation_Succeeded.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationSu
cceeded;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the evtHLAobjectInstanceNameReservationSucceeded for
ChatRoomRegistry
 */
public plan
plnHLA_ChatRoomRegistry_NameReservation_Succeeded
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAobjectInstanceNameReservationSucceeded ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean
relevant(evtHLAobjectInstanceNameReservationSucceeded ev)
   {
      return
ev.objectName.equals(Server.HLAchat._name_ChatRoomRegistry);
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      //Having reserved the name, we know we're the first federate
      //to reach this point, so we must create the ChatRoomRegistry.
      HLA._ChatRoomRegistry.owned = HLA._ChatRoomRegistry.subscribed =
true;
 //       HLA._ChatRoomRegistry.divesting = false;
      HLA._ChatRoomRegistry.handle =
HLA._rtiAmbassador.registerObjectInstance( HLA._och_ChatRoomRegistry,
HLA._ChatRoomRegistry.name );
      HLA._rtiAmbassador.subscribeObjectClassAttributes(
HLA._och_ChatRoomRegistry, HLA._oahs_ChatRoomRegistry_forUpdate );
      //Signal the waiting plnLoginUser that we're done
      HLA.sem_name_reservation.setChanged();
   }
}
//end plnHLA_ChatRoomRegistry_NameReservation_Succeeded
```

The `plnHLA_ChatRoomRegistry_OwnershipAcquisitionFailed` **plan handles the failed outcome of a ChatRoomRegistry ownership acquisition attempt.**

```
// File: plnHLA_ChatRoomRegistry_OwnershipAcquisitionFailed.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipUnavailable;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the AttributeOwnershipUnavailable notification for
ChatRoomRegistry
 */
public plan
plnHLA_ChatRoomRegistry_OwnershipAcquisitionFailed
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributeOwnershipUnavailable ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAattributeOwnershipUnavailable ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
//    ev.theObjectClass.equals(
((Server.HLAchat)_HLA.as_object())._och_ChatRoomRegistry );
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoomRegistry );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      HLA.sem_ChatRoomRegistry_acquisition.setChanged();
   }
}
//end plnHLA_ChatRoomRegistry_OwnershipAcquisitionFailed
```

The plnHLA_ChatRoomRegistry_OwnershipAcquisitionNotification plan handles the successful outcome of a ChatRoomRegistry ownership acquisition attempt.

```
// File: plnHLA_ChatRoomRegistry_OwnershipAcquisitionNotification.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipAcquisitionNo
tification;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the attribute ownership notification for ChatRoomRegistry
 */
public plan
plnHLA_ChatRoomRegistry_OwnershipAcquisitionNotification
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributeOwnershipAcquisitionNotification ev;
   #posts event evtHLA_ForceDivest evHLA_ForceDivest;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean
relevant(evtHLAattributeOwnershipAcquisitionNotification ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoomRegistry );
   }
   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      @wait_for( HLA._sem_ChatRoomRegistry.planWait() );
//    synchronized(HLA._ChatRoomRegistry)
      {
         HLA._ChatRoomRegistry.owned = true || ( 
HLA._ChatRoomRegistry.divesting = HLA._me_shutting_down );
      } //synchronized(HLA._ChatRoomRegistry)
      HLA._sem_ChatRoomRegistry.signal();
      HLA.sem_ChatRoomRegistry_acquisition.setChanged();
      //Just in case we somehow managed to acquire whilst switching to 
shutting down mode
      if (HLA._me_shutting_down) server.postEvent( 
evHLA_ForceDivest.create( ev.identifier ) );
   }
}
//end plnHLA_ChatRoomRegistry_OwnershipAcquisitionNotification
```

The `plnHLA_ChatRoomRegistry_OwnershipAssumptionRequest` plan handles ownership assumption requests for the ChatRoomRegistry object.

```
// File: plnHLA_ChatRoomRegistry_OwnershipAssumptionRequest.java
package server;

import 
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipAssump
tion;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles OwnershipAssumptionRequests for ChatRoomRegistry
 */
public plan 
plnHLA_ChatRoomRegistry_OwnershipAssumptionRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestAttributeOwnershipAssumption ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestAttributeOwnershipAssumption 
ev)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoomRegistry );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      //Decline if we're in the process of shutting down (and thus
divesting)
      //Note that we return true because the plan was a success
      //even though we simply decided to ignore the request
      if (HLA._me_shutting_down) return true;
      //Acquiesce if able
      //This condition is similar to !_me_logged_in but better
      //If not subscribed, probably not up to date --decline
      if (!HLA._ChatRoomRegistry.subscribed) return true;
      //Note that the divesting federate will have offered ownership
to all federates, and that even if they all acquiesce,
      //only one will receive an ownershipAcquisitionNotification; if
we use attributeOwnershipAcquisition, there won't be any
      //negative feedback if we fail to get ownership --and we'll have
an outstanding acquisition request.
      //This is why it is preferable to use
attributeOwnershipAcquisitionIfAvailable
      HLA._rtiAmbassador.attributeOwnershipAcquisitionIfAvailable(
HLA._ChatRoomRegistry.handle, HLA._oahs_ChatRoomRegistry);
   }
}
//end plnHLA_ChatRoomRegistry_OwnershipAssumptionRequest
```

The `plnHLA_ChatRoomRegistry_OwnershipDivestitureConfirmationRequest` **plan handles requests for confirmation of divestiture of the ChatRoomRegistry object.**

```
// File:
plnHLA_ChatRoomRegistry_OwnershipDivestitureConfirmationRequest.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestDivestitureConfirmation;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles requests for confirmation of ownership divestiture of
ChatRoomRegistry
 */
public plan
plnHLA_ChatRoomRegistry_OwnershipDivestitureConfirmationRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestDivestitureConfirmation ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestDivestitureConfirmation ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
//    ev.theObjectClass.equals(
((Server.HLAchat)_HLA.as_object())._och_ChatRoomRegistry );
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoomRegistry );
   }
   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      @wait_for( HLA._sem_ChatRoomRegistry.planWait() );
//    synchronized(HLA._ChatRoomRegistry)
      {
         HLA._rtiAmbassador.confirmDivestiture(
HLA._ChatRoomRegistry.handle, HLA._oahs_ChatRoomRegistry, null );
         HLA._ChatRoomRegistry.owned = HLA._ChatRoomRegistry.divesting
= false;
      } //synchronized(HLA._ChatRoomRegistry)
      HLA._sem_ChatRoomRegistry.signal();
      //There'll be a divestiture semaphore of some sort when logging
off
      HLA.sem_ChatRoomRegistry_divestiture.setChanged();
   }
}
//end plnHLA_ChatRoomRegistry_OwnershipDivestitureConfirmationRequest
```

The `plnHLA_ChatRoomRegistry_OwnershipReleaseRequest` plan handles ownership release requests for the ChatRoomRegistry object.

```
// File: plnHLA_ChatRoomRegistry_OwnershipReleaseRequest.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipReleas
e;

/**
Handles requests for ownership release of ChatRoomRegistry
 */
public plan
plnHLA_ChatRoomRegistry_OwnershipReleaseRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestAttributeOwnershipRelease ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestAttributeOwnershipRelease ev)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoomRegistry );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      //Acquiesce
      @wait_for( HLA._sem_ChatRoomRegistry.planWait() );
//    synchronized(HLA._ChatRoomRegistry)
      {
         //Plan succeeds even though divestiture fails
         if (!HLA._oahs_ChatRoomRegistry.containsAll(
HLA._rtiAmbassador.attributeOwnershipDivestitureIfWanted(
HLA._ChatRoomRegistry.handle, HLA._oahs_ChatRoomRegistry))) return
true;
         HLA._ChatRoomRegistry.owned = HLA._ChatRoomRegistry.divesting
= false;
      } //synchronized(_ChatRoomRegistry)
      HLA._sem_ChatRoomRegistry.signal();
      HLA.sem_ChatRoomRegistry_divestiture.setChanged();
   }
}
//end plnHLA_ChatRoomRegistry_OwnershipReleaseRequest
```

The `plnHLA_ChatRoomRegistry_ProvideAttributeValueUpdate` **plan handles requests for ChatRoomRegistry attribute value updates.**

```
// File: plnHLA_ChatRoomRegistry_ProvideAttributeValueUpdate.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAprovideAttributeValueUpdate;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;

/**
Handles attribute value update requests received from the RTI for the
ChatRoomRegistry.
 */
public plan
plnHLA_ChatRoomRegistry_ProvideAttributeValueUpdate
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAprovideAttributeValueUpdate ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtHLAprovideAttributeValueUpdate ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoomRegistry );
   }

   #reasoning method
   body()
   {
      AttributeHandleValueMap _ahvm_attributeValues =
HLA._rtiAmbassador.getAttributeHandleValueMapFactory().create(
HLA._oahs_ChatRoomRegistry_forUpdate.size() );
      //HLAprivilegeToDeleteObject is of undefined type (it has no
content)
//    _ahvm_attributeValues.put(
HLA._oah_ChatRoomRegistry_DeletePrivilege, null);
      _ahvm_attributeValues.put( HLA._oah_ChatRoomRegistry_list,
HLA._ChatRoomRegistry.list.toByteArray() );
      HLA._rtiAmbassador.updateAttributeValues(
HLA._ChatRoomRegistry.handle, _ahvm_attributeValues, null );
   }
}
//end plnHLA_ChatRoomRegistry_ProvideAttributeValueUpdate
```

The `plnHLA_ChatRoomRegistry_ReflectAttributeValueUpdate` **plan handles ChatRoomRegistry attribute value update reflections.**

```
// File: plnHLA_ChatRoomRegistry_ReflectAttributeValueUpdate.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAreflectAttributeValues;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles attribute value updates received from the RTI for the
ChatRoomRegistry.
 */
public plan
plnHLA_ChatRoomRegistry_ReflectAttributeValueUpdate
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAreflectAttributeValues ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtHLAreflectAttributeValues ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoomRegistry );
   }

   #reasoning method
   body()
   {
      //HLAprivilegeToDeleteObject has no content, so we won't decode
it
      HLA._ChatRoomRegistry.list.decode( (byte[])ev.theAttributes.get(
HLA._oah_ChatRoomRegistry_list ) );
   }
}
//end plnHLA_ChatRoomRegistry_ReflectAttributeValueUpdate
```

The `plnHLA_ChatRoom_Discovery` plan handles the discovery of ChatRoom objects (including the Waiting Room).

```
// File: plnHLA_ChatRoom_Discovery.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAdiscoverObjectInstance;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles discovery of ChatRooms, including the "_waiting_room".
 */
public plan
plnHLA_ChatRoom_Discovery
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAdiscoverObjectInstance ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAdiscoverObjectInstance ev)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      ev.theObjectClass.equals( HLA._och_ChatRoom );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      //Assuming AutoProvide, this'll be immediately followed by an
Update
      Server.HLAchat.aChatRoom _ChatRoom;
      if (ev.objectName.equals(
Server.HLAchat._name_waiting_room_ChatRoom ))
      {
         _ChatRoom = HLA._waiting_room_ChatRoom;
      } else {
//       _ChatRoom = HLA.getNewChatRoom(); //Awaiting bug fix
         _ChatRoom = HLA.new aChatRoom();
      }
      _ChatRoom.handle = ev.theObject;
      _ChatRoom.subscribed = true;
//    _ChatRoom.name and slot will come from Update; we must wait
until then before updating the GUI
      @wait_for( HLA._sem_theChatRooms.planWait() );
      HLA._theChatRooms.put( ev.theObject, _ChatRoom );
      HLA._sem_theChatRooms.signal();
      //It is premature to add the ChatRoom to the blfdatGrpList,
since
      //all we know at this point is the HLA name (ev.objectName),
*not*
      //the ChatRoom's "name" attribute.

      //Special case: waiting room
      //The discovery of this never-deleted ChatRoom is always waited
upon
      //We do not want to trip the discovery semaphore (waiting for a
Participant) with a ChatRoom discovery
      if ( !ev.objectName.equals(
Server.HLAchat._name_waiting_room_ChatRoom ) ) return true;
      //Signal the waiting plnHLA_WaitingRoomNameReservation that
we're done
      HLA.sem_ChatRoom_discovery.setChanged();
   }
}
//end plnHLA_ChatRoom_Discovery
```

The `plnHLA_ChatRoom_OwnershipAcquisitionFailed` **plan handles the failed outcome of ChatRoom attribute ownership requests.**

```
// File: plnHLA_ChatRoom_OwnershipAcquisitionFailed.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipUnavailable;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the AttributeOwnershipUnavailable notification for ChatRooms
 */
public plan
plnHLA_ChatRoom_OwnershipAcquisitionFailed
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributeOwnershipUnavailable ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAattributeOwnershipUnavailable ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
//    ev.theObjectClass.equals(
((Server.HLAchat)_HLA.as_object())._och_ChatRoomRegistry );
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }

   #reasoning method
   body()
   {
      HLA.sem_ChatRoom_acquisition.setChanged();
   }
}
//end plnHLA_ChatRoom_OwnershipAcquisitionFailed
```

The `plnHLA_ChatRoom_OwnershipAcquisitionNotification` plan handles the successful outcome of ChatRoom attribute ownership requests.

```
// File: plnHLA_ChatRoom_OwnershipAcquisitionNotification.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipAcquisitionNo
tification;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the attribute ownership notification for ChatRooms
 */
public plan
plnHLA_ChatRoom_OwnershipAcquisitionNotification
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributeOwnershipAcquisitionNotification ev;
   #posts event evtHLA_ForceDivest evHLA_ForceDivest;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean
relevant(evtHLAattributeOwnershipAcquisitionNotification ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }
   #reasoning method
   body()
   {
      @wait_for( HLA._sem_theChatRooms.planWait() );
//    synchronized(HLA._theChatRooms)
      Server.HLAchat.aChatRoom _ChatRoom =
HLA.SeekChatRoom(ev.theObject);
//    //end of synchronized(HLA._theChatRooms)
      HLA._sem_theChatRooms.signal();
      _ChatRoom.owned = !(_ChatRoom.divesting = false);
      HLA.sem_ChatRoom_acquisition.setChanged();
      //Just in case we somehow managed to acquire whilst switching to
shutting down mode
      if (HLA._me_shutting_down) server.postEvent(
evHLA_ForceDivest.create(ev.identifier) );
   }
}
//end plnHLA_ChatRoom_OwnershipAcquisitionNotification
```

The `plnHLA_ChatRoom_OwnershipAssumptionRequest` plan handles ownership assumption requests for ChatRoom objects.

```
// File: plnHLA_ChatRoom_OwnershipAssumptionRequest.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipAssump
tion;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles OwnershipAssumptionRequests for ChatRooms
 */
public plan
plnHLA_ChatRoom_OwnershipAssumptionRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestAttributeOwnershipAssumption ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestAttributeOwnershipAssumption
ev)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
//    ev.theObjectClass.equals(
((Server.HLAchat)_HLA.as_object())._och_ChatRoom );
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      //Decline if we're in the process of shutting down (and thus
divesting)
      //Note that we return true because the plan was a success
      //even though we simply decided to ignore the request
      if (HLA._me_shutting_down) return true;
      //Acquiesce if able
      @wait_for( HLA._sem_theChatRooms.planWait() );
      Server.HLAchat.aChatRoom _ChatRoom =
HLA.SeekChatRoom(ev.theObject);
      HLA._sem_theChatRooms.signal();
//    if (_ChatRoom == null) throw new ObjectInstanceNotKnown("Unknown
ChatRoom offered");
      //Also decline if:
      //We're not subscribed, thus the values are probably not up to
date
      if (!_ChatRoom.subscribed) return true;
      //The HLA federates also check to see if they're logged out and
      //the ChatRoom slot is other than the waiting_room, because they
      //can remain joined whilst logged out --not so the JACK
      //federates, which resign and shut down when they log out.
      //Since ownership is offered only when the owner leaves a
      //ChatRoom and knows there are other federates in that ChatRoom,
      //accept only if a) it's the waiting room (which is persistent)
      //or b) we're in the room being offered
      //Could use _me.chat_room_slot instead of _myChatRoom.slot
      if ((!_ChatRoom.slot.equals( HLA._waiting_room_ChatRoom )) &&
          (!_ChatRoom.slot.equals( HLA._myChatRoom.slot ))          )
return true;

      //Note that the divesting federate will have offered ownership
      //to all federates, and that even if they all acquiesce, only
      //one will receive an ownershipAcquisitionNotification; if we
      //use attributeOwnershipAcquisition, there won't be any negative
      //feedback if we fail to get ownership --and we'll have an
      //outstanding acquisition request.
      //This is why it is preferable to use
attributeOwnershipAcquisitionIfAvailable
      HLA._rtiAmbassador.attributeOwnershipAcquisitionIfAvailable(
_ChatRoom.handle, HLA._oahs_ChatRoom); //or theObject
   }
}
//end plnHLA_ChatRoom_OwnershipAssumptionRequest
```

The plnHLA_ChatRoom_OwnershipDivestitureConfirmationRequest **plan handles requests for confirmation of divestiture of ChatRoom objects.**

```
// File: plnHLA_ChatRoom_OwnershipDivestitureConfirmationRequest.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestDivestitureConfirmation;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles requests for confirmation of ownership divestiture of
ChatRooms
 */
public plan
plnHLA_ChatRoom_OwnershipDivestitureConfirmationRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestDivestitureConfirmation ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestDivestitureConfirmation ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
//    ev.theObjectClass.equals(
((Server.HLAchat)_HLA.as_object())._och_ChatRoom );
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }
   #reasoning method
   body()
   {
//     Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
//     synchronized(HLA._theChatRooms)
      @wait_for( HLA._sem_theChatRooms.planWait() );
      Server.HLAchat.aChatRoom _ChatRoom =
HLA.SeekChatRoom(ev.theObject);
//     //end of synchronized(HLA._theChatRooms)
      HLA._sem_theChatRooms.signal();
      HLA._rtiAmbassador.confirmDivestiture( _ChatRoom.handle,
HLA._oahs_ChatRoom, null );
      _ChatRoom.owned = _ChatRoom.divesting = false;
      //There'll be a divestiture semaphore of some sort when logging
off
      HLA.sem_ChatRoom_divestiture.setChanged();
   }
}
//end plnHLA_ChatRoom_OwnershipDivestitureConfirmationRequest
```

The `plnHLA_ChatRoom_OwnershipReleaseRequest` **plan handles ownership release requests for ChatRoom objects.**

```
// File: plnHLA_ChatRoom_OwnershipReleaseRequest.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipReleas
e;

/**
Handles requests for ownership release of ChatRooms
 */
public plan
plnHLA_ChatRoom_OwnershipReleaseRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestAttributeOwnershipRelease ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestAttributeOwnershipRelease ev)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }

   #reasoning method
   body()
   {
      //Acquiesce
      @wait_for( HLA._sem_theChatRooms.planWait() );
//    synchronized(HLA._theChatRooms)
      {
         Server.HLAchat.aChatRoom _ChatRoom =
HLA.SeekChatRoom(ev.theObject);
         //Plan succeeds even though divestiture fails
         if (!HLA._oahs_ChatRoom.containsAll(
HLA._rtiAmbassador.attributeOwnershipDivestitureIfWanted(
_ChatRoom.handle, HLA._oahs_ChatRoom))) return true;
         _ChatRoom.owned = _ChatRoom.divesting = false;
      } //synchronized(_theChatRooms)
      HLA._sem_theChatRooms.signal();
      HLA.sem_ChatRoom_divestiture.setChanged();
   }
}
//end plnHLA_ChatRoom_OwnershipReleaseRequest
```

The `plnHLA_ChatRoom_ProvideAttributeValueUpdate` **plan handles requests for ChatRoom instance attribute value updates.**

```
// File: plnHLA_ChatRoom_ProvideAttributeValueUpdate.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAprovideAttributeValueUpdate;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;

/**
Handles attribute value update requests received from the RTI for the
ChatRooms.
 */
public plan
plnHLA_ChatRoom_ProvideAttributeValueUpdate
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAprovideAttributeValueUpdate ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtHLAprovideAttributeValueUpdate ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }

   #reasoning method
   body()
   {
      @wait_for( HLA._sem_theChatRooms.planWait() );
      Server.HLAchat.aChatRoom _ChatRoom =
HLA.SeekChatRoom(ev.theObject);
      HLA._sem_theChatRooms.signal();
      AttributeHandleValueMap _ahvm_attributeValues =
HLA._rtiAmbassador.getAttributeHandleValueMapFactory().create(
HLA._oahs_ChatRoom_forUpdate.size() );
      _ahvm_attributeValues.put( HLA._oah_ChatRoom_name,
_ChatRoom.name.toByteArray() );
      _ahvm_attributeValues.put( HLA._oah_ChatRoom_slot,
_ChatRoom.slot.toByteArray() );
      HLA._rtiAmbassador.updateAttributeValues( _ChatRoom.handle,
_ahvm_attributeValues, null );
   }
}
//end plnHLA_ChatRoom_ProvideAttributeValueUpdate
```

The `plnHLA_ChatRoom_ReflectAttributeValueUpdate` **plan handles ChatRoom instance attribute value update reflections.**

```
// File: plnHLA_ChatRoom_ReflectAttributeValueUpdate.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAreflectAttributeValues;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles attribute value updates received from the RTI for the
ChatRooms.
 */
public plan
plnHLA_ChatRoom_ReflectAttributeValueUpdate
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAreflectAttributeValues ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtHLAreflectAttributeValues ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }

   #reasoning method
   body()
   {
      @wait_for( HLA._sem_theChatRooms.planWait() );
      Server.HLAchat.aChatRoom _ChatRoom =
HLA.SeekChatRoom(ev.theObject);
      HLA._sem_theChatRooms.signal();
      {
         //Name is a true attribute, not the object's HLA name
         _ChatRoom.name.decode( (byte[])ev.theAttributes.get(
HLA._oah_ChatRoom_name ) );
         _ChatRoom.slot.decode( (byte[])ev.theAttributes.get(
HLA._oah_ChatRoom_slot ) );

         //ChatRooms (Groups) will be stored using their full HLA
         //names; the leading character will be added/stripped at the
         //client/server agent interface

         //Adding the ChatRoom's name to the list every time we get an
         //update could be a waste of time; fortunately, ChatRoom
         //attributes never change so we'll only get this event after
         //a discovery.
         //We will, however, get it once for each Client...
//       if (!_ChatRoom.name.toString().equals(
HLA._name_waiting_room_ChatRoom ))
//       blfdatGrpList.add( _ChatRoom.name.toString().substring(1) );
      }
   }
}
//end plnHLA_ChatRoom_ReflectAttributeValueUpdate
```

The `plnHLA_ChatRoom_Removal` plan handles ChatRoom object instance removals.

```
// File: plnHLA_ChatRoom_Removal.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAremoveObjectInstance;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the removal of ChatRoom objects.
 */
public plan
plnHLA_ChatRoom_Removal
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAremoveObjectInstance ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAremoveObjectInstance ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_ChatRoom );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      Server.HLAchat.aChatRoom _ChatRoom =
(Server.HLAchat.aChatRoom)HLA._theChatRooms.remove( ev.theObject );
      //In the HLA GUI Chat, the <General> ChatRoom remains on the
list
      //of ChatRooms even whilst non-existent.  There is no such list
here.
//    if (_ChatRoom.name.toString().equals( HLA._name_general_ChatRoom
)) return true;
      //This must be true
      // remove group from groupList
//    blfdatGrpList.remove( _ChatRoom.name.toString() );
   }
}
//end plnHLA_ChatRoom_Removal
```

The `plnHLA_WaitingRoom_NameReservation_Failed` **plan handles the failed outcome of the Waiting Room name reservation.**

```
// File: plnHLA_WaitingRoom_NameReservation_Failed.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationFa
iled;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles reservation of the "_waiting_room" ChatRoom name.
 */
public plan
plnHLA_WaitingRoom_NameReservation_Failed
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAobjectInstanceNameReservationFailed ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAobjectInstanceNameReservationFailed
ev)
   {
      return
ev.objectName.equals(Server.HLAchat._name_waiting_room_ChatRoom);
   }

   context()
   {
       datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      //Name reservation failed, which means there is an already
extant instance
      HLA.sem_ChatRoom_discovery.clearChanged();
      HLA._waiting_room_ChatRoom.subscribed = true;
      HLA._rtiAmbassador.subscribeObjectClassAttributes(
HLA._och_ChatRoom, HLA._oahs_ChatRoom_forUpdate );
      @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_ChatRoom_discovery, HLA.sem_ChatRoom_discovery.hasChanged() )
);
      //Signal the waiting plnLoginUser that we're done
      HLA.sem_name_reservation.setChanged();
   }
}
//end plnHLA_WaitingRoom_NameReservation_Failed
```

The `plnHLA_WaitingRoom_NameReservation_Succeeded` plan handles the successful outcome of the Waiting Room name reservation.

```
// File: plnHLA_WaitingRoom_NameReservation_Succeeded.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationSu
cceeded;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles reservation of the "_waiting_room" ChatRoom name.
 */
public plan
plnHLA_WaitingRoom_NameReservation_Succeeded
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAobjectInstanceNameReservationSucceeded ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean
relevant(evtHLAobjectInstanceNameReservationSucceeded ev)
   {
      return
ev.objectName.equals(Server.HLAchat._name_waiting_room_ChatRoom);
   }

   context()
   {
       datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }
   #reasoning method
   body()
   {
      //Having reserved the name, we know we're the first federate
      //to reach this point, so we must create the _waiting_room
ChatRoom.
      HLA._waiting_room_ChatRoom.owned = true;
      HLA._waiting_room_ChatRoom.subscribed = true;
//    HLA._waiting_room_ChatRoom.divesting = false;
      @wait_for( HLA._sem_theChatRooms.planWait() );
      HLA._theChatRooms.put( HLA._waiting_room_ChatRoom.handle =
HLA._rtiAmbassador.registerObjectInstance( HLA._och_ChatRoom,
HLA._waiting_room_ChatRoom.name.toString()),
HLA._waiting_room_ChatRoom );
      HLA._sem_theChatRooms.signal();
      HLA._rtiAmbassador.subscribeObjectClassAttributes(
HLA._och_ChatRoom, HLA._oahs_ChatRoom_forUpdate );
      //Signal the waiting plnLoginUser that we're done
      HLA.sem_name_reservation.setChanged();
   }
}
//end plnHLA_WaitingRoom_NameReservation_Succeeded
```

The `plnHLA_ParticipantEntersGeneralChatRoom` **plan handles the subtask of “entering” a Client’s Participant avatar into the General ChatRoom.**

```
// File: plnHLA_ParticipantEntersGeneralChatRoom.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;

/**
Handles the subtask of entering the (owned) Participant into the
General ChatRoom.
 */
public plan
plnHLA_ParticipantEntersGeneralChatRoom
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLA_ParticipantEntersGeneralChatRoom ev;
   #posts event evtHLA_AcquireChatRoomRegistry ev_CRR;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant( evtHLA_ParticipantEntersGeneralChatRoom ev
)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }

   #reasoning method
   body()
   {
      //Complete log-in process by entering owned Participant into the
General ChatRoom
      //Does the General ChatRoom exist?
      @wait_for( HLA._sem_theChatRooms.planWait() );
      {
         HLA._general_ChatRoom = HLA.SeekChatRoomBySlot(
HLA._slot_general_ChatRoom );
         if (null == HLA._general_ChatRoom)
         {
            @subtask( ev_CRR.create( ev.identifier ) );
//          synchronized(AcquireChatRoomRegistry())
            {
//             HLA._general_ChatRoom = HLA.new ChatRoom(
HLA._name_general_ChatRoom, HLA._slot_general_ChatRoom);
               HLA._general_ChatRoom = HLA.getNewChatRoom(
HLA._name_general_ChatRoom, HLA._slot_general_ChatRoom);
               HLA._general_ChatRoom.owned =
HLA._general_ChatRoom.subscribed = true;
//             HLA._general_ChatRoom.divesting = false;
               HLA._theChatRooms.put( HLA._general_ChatRoom.handle =
HLA._rtiAmbassador.registerObjectInstance( HLA._och_ChatRoom ),
HLA._general_ChatRoom );
               //No need to add the General ChatRoom to the
_ChatRoomRegistry, as it is already listed
            } //synchronized(AcquireChatRoomRegistry())
            HLA._sem_ChatRoomRegistry.signal();
         } else {
         } //if
      } //synchronized(_theChatRooms)
      HLA._sem_theChatRooms.signal();

      //This association will trigger Attribute Scope Advisories,
Discovery:
      HLA._myChatRoom = HLA._general_ChatRoom;
      HLA._me.chat_room_slot.setValue( HLA._slot_general_ChatRoom );
      HLA._me_logged_in = !(HLA._me_logging_in = false);
      HLA._rtiAmbassador.associateRegionsForUpdates( HLA._me.handle,
HLA._asrspl_Participant_current );

      HLA._rtiAmbassador.subscribeObjectClassAttributesWithRegions(
HLA._och_Participant, HLA._asrspl_Participant_current);

      //Subscription will refresh subscribed Participants;
      //since we use Auto-Provide, an explicit Update request is not
needed
```

```
      //Subscribe to the interaction
      //We'll be listening to interactions that come in on our user-
handle channel in addition to the chat-room-slot channel
      //It is the interaction sender's responsibility to pick the
channels to use
      HLA._rh_myParticipantRegion = HLA._rtiAmbassador.createRegion(
HLA._dhs_UserHandleSlotsSet );
      //setRangeBounds must be invoked at least once for each
dimension specified.
      //Only then can commitRegionModifications be invoked to turn the
region template into a region specification.
      HLA._rtiAmbassador.setRangeBounds( HLA._rh_myParticipantRegion,
HLA._dh_UserHandleSlots, new RangeBounds(
HLA._me.user_handle.getValue(), HLA._me.user_handle.getValue() + 1 )
);
      HLA._rhs_myParticipantRegion =
HLA._rtiAmbassador.getRegionHandleSetFactory().create();
      HLA._rhs_myParticipantRegion.add( HLA._rh_myParticipantRegion );
      HLA._rtiAmbassador.commitRegionModifications(
HLA._rhs_myParticipantRegion );
      //subscribeInteractionClassWithRegions done by plnLoginUser
   }
}
//end plnHLA_ParticipantEntersGeneralChatRoom
```

The `plnHLA_Participant_AttributeScopeAdvisory_In` **plan handles the attribute scope advisory for a Participant instance coming into scope.**

```
// File: plnHLA_Participant_AttributeScopeAdvisory_In.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributesInScope;

/**
Handles the Attribute Scope Advisories for Participants.
 */
public plan
plnHLA_Participant_AttributeScopeAdvisory_In
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributesInScope ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAattributesInScope ev)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }

   #reasoning method
   body()
   {
      //The Participant has just come into or gone out of scope,
      //which means either we or it has changed ChatRooms
      //(it cannot have been truly deleted)
      @wait_for( HLA._sem_theParticipants.planWait() );
      Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipant(ev.theObject);
      HLA._sem_theParticipants.signal();
      //If we could localDelete Participants as they go out of scope,
      //we would always get a Discovery right before the InScope
      //callback; but we can't do that because of the pRTI
      //RTIambassador-Federate Service Thread synch bug (putting the
      //Federate Service Thread in any kind of synch-wait state (a
      //Semaphore, say) causes a federate-triggering RTIambassador
      //call by *any* thread to hang, even if the latter
      //RTIambassador-caller isn't owning any monitors).
      //So we use the inScope property of aParticipant to work around
it.
      //We know we do not own theObject, since we wouldn't get any
advisories in that case
      _Participant.inscope = true;
      //The Java Chat federate uses this event to add/remove
      //Participants to its drop-down list of private message targets;
      //the JACK Chat federates resolve that list only when a Client
      //sends an evtRequestGrpWho, so there is no further processing
      //required here.
   }
}
//end plnHLA_Participant_AttributeScopeAdvisory_In
```

The `plnHLA_Participant_AttributeScopeAdvisory_Out` **plan handles the attribute scope advisory for a Participant instance going out of scope.**

```
// File: plnHLA_Participant_AttributeScopeAdvisory_Out.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributesOutOfScope;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the Attribute Scope Advisories for Participants.
 */
public plan plnHLA_Participant_AttributeScopeAdvisory_Out extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributesOutOfScope ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAattributesOutOfScope ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }
   #reasoning method
   body()
   {
      //The Participant has just gone out of scope,
      //which means either we or it has changed ChatRooms
      //(it cannot have been truly deleted)
      @wait_for( HLA._sem_theParticipants.planWait() );
      Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipant(ev.theObject);
      HLA._sem_theParticipants.signal();
      //If we could localDelete Participants as they go out of scope,
      //we would always get a Discovery right before the InScope
      //callback; but we can't do that because of the pRTI
      //RTIambassador-Federate Service Thread synch bug (putting the
      //Federate Service Thread in any kind of synch-wait state (a
      //Semaphore, say) causes a federate-triggering RTIambassador
      //call by *any* thread to hang, even if the latter
      //RTIambassador-caller isn't owning any monitors).
      //So we use the inScope property of aParticipant to work around
it.
      //We know we do not own theObject, since we wouldn't get any
advisories in that case
      _Participant.inscope = false;
      //The Java Chat federate uses this event to add/remove
      //Participants to its drop-down list of private message targets;
      //the JACK Chat federates resolve that list only when a Client
      //sends an evtRequestGrpWho, so there is no further processing
      //required here.
   }
}
//end plnHLA_Participant_AttributeScopeAdvisory_Out
```

The `plnHLA_Participant_Discovery` **plan handles the discovery of other Participant instances.**

```
// File: plnHLA_Participant_Discovery.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAdiscoverObjectInstance;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the discovery of Participant objects
 */
public plan
plnHLA_Participant_Discovery
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAdiscoverObjectInstance ev;
   #uses interface Server server;
   #uses data blfHLA datHLA;
   static boolean relevant(evtHLAdiscoverObjectInstance ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      ev.theObjectClass.equals( HLA._och_Participant );
   }

   #reasoning method
   body()
   {
      logical Object $HLA2;

      Server.HLAchat.aParticipant _Participant =
HLA.getNewParticipant();
//    Server.HLAchat.aParticipant _Participant = HLA.new
Participant();
      _Participant.subscribed = true;
//    _Participant.inscope = false; //Default; the InScope advisory
will follow discovery in any case
      _Participant.handle = ev.theObject;
//    _Participant.name.setValue(
HLA._rtiAmbassador.getObjectInstanceName( ev.theObject ) );
      _Participant.name.setValue( ev.objectName );

      @wait_for( HLA._sem_theParticipants.planWait() );
      HLA._theParticipants.put( ev.theObject, _Participant);
      HLA._sem_theParticipants.signal();
      //When we first tried to maintain the old JACK belief sets, this
      //got complicated here.
      //At this point we don't know which ChatRoom slot the
      //Participant is in, so we couldn't add to blfdatGroups (mapping
      //of usernames to groups); we'd have to await an Update for
      //that.
      //Whether the Participant discovered by this JACK client is
      //another JACK client or not we can tell because a JACK client
      //first adds itself to blfdatHLA before logging in. Not so with
      //blfdatUsers, which is added to after the log in is complete.
      //
      //Now, in using only the blfdatHLA, we don't need to bother.
      //What the Participant objects map to becomes irrelevant;
      //interaction send and receive is done through the RTI instead
      //of through direct Server intervention.  Basically, the Server
      //relays the send to the RTI, which then callbacks the pertinent
      //JACK clients; this goes through the Server again, which then
      //delivers the interaction instances to each Client instance.

//    if (HLA._me_shutting_down) return true;
      //We use the Auto-Provide switch, so an explicit Update request
is not needed
   }
}
//end plnHLA_Participant_Discovery
```

The `plnHLA_Participant_NameReservation_Failed` **plan handles the failed outcome of Participant name reservations.**

```
// File: plnHLA_Participant_NameReservation_Failed.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationFa
iled;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;

/**
Handles outcome of Participant (username) name reservation request.
 */
public plan
plnHLA_Participant_NameReservation_Failed
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAobjectInstanceNameReservationFailed ev;
   #posts event evtHLA_ParticipantEntersGeneralChatRoom ev_PEGCR;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant( evtHLAobjectInstanceNameReservationFailed
ev )
   {
      return ( ev.objectName.charAt(0) == 'p' );
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }
   #reasoning method
   body()
   {
      /**
       * blfdatUsers does not list non-JACK clients (usernames)
       */
      //Prepare the general chat room association
      HLA._rhs_current_ChatRoom =
HLA._rtiAmbassador.getRegionHandleSetFactory().create();
      //Arrival ( <General> ) ChatRoom will be slot 2, so we set up
"current" accordingly
      HLA._rh_current_ChatRoom = HLA._rh_general_ChatRoom;
      HLA._rhs_current_ChatRoom.add( HLA._rh_current_ChatRoom );
      HLA._rtiAmbassador.commitRegionModifications(
HLA._rhs_current_ChatRoom ); //Won't complain if there are no mods to
commit
      HLA._asrspl_Participant_current =
HLA._rtiAmbassador.getAttributeSetRegionSetPairListFactory().create(1)
;
      HLA._asrspl_Participant_current.add( new
AttributeRegionAssociation( HLA._oahs_Participant_forUpdate,
HLA._rhs_current_ChatRoom ));
      //Note that the association has not been applied yet.
      //Name reservation failed, which means there is an already
extant instance.
      //At this point, we know the desired Participant object exists -
-we just don't know where it is.
      //If it is logged-out, it'll be in the waiting_room and we will
      //discover it there and can then acquire it.
      //It is logged-in by someone else, it'll be in some other
      //ChatRoom (2+) and we won't discover it and cannot use it.
      //There is no "fail-fast" in that situation, however.
      //It is reasonably safe to assume that if we don't know of the
      //sought Participant, it must be logged in by someone else.

      //Is the object known?
      Server.HLAchat.aParticipant _Participant;
      try
      {
         @wait_for( HLA._sem_theParticipants.planWait() );
         //getObjectInstanceHandle will throw an exception if the
object is unknown
         //We put a try-finally around it to avoid having to signal()
within the outer catch block
         try
         {
            _Participant = HLA.SeekParticipant(
HLA._rtiAmbassador.getObjectInstanceHandle( HLA._me.name.toString() )
);
         } finally {
            HLA._sem_theParticipants.signal();
         }

         //No exception occurred, therefore the object is known; could
         //be anywhere, however
         //If freshly discovered, we could wait for its user_handle to
         //be updated by reflectAttributeValues (this is the only
         //field guaranteed to change) so that we can then safely
         //look up its logged_in or chat_room_slot values.
         //Instead, we'll request ownership right away; a logged-in
         //Participant will fail.

         //It could be already owned (if it was an unused Participant
we just happened to have the custody of)
         if (!_Participant.owned)
         {
            //For a Participant to be eligible for acquisition, it
            //must be in the _waiting_room and therefore inscope
            if (_Participant.inscope)
            {
               HLA.sem_Participant_acquisition.clearChanged();
               //Before acquiring, set up update regions so they do
not lapse during ownership transfer
               HLA._rtiAmbassador.associateRegionsForUpdates(
_Participant.handle, HLA._asrspl_Participant_nowhere );
               HLA._rtiAmbassador.associateRegionsForUpdates(
_Participant.handle, HLA._asrspl_Participant_waiting_room );
               HLA._rtiAmbassador.attributeOwnershipAcquisition(
_Participant.handle, HLA._oahs_Participant, null );
               @wait_for( new aos.jack.util.cursor.Change(
HLA.sem_Participant_acquisition,
HLA.sem_Participant_acquisition.hasChanged() ) );

               //The plan handling the acquisition request outcome
               //will set HLA._me_logging_in to false (and
               //HLA._me.name.setValue("")) in case of failure (which
               //happens if the object was discovered in the
               //waiting_room and then logged-in by someone else
               //before we could get to it).
            } else {
               HLA._me_logging_in = false;
               HLA._me.name.setValue("");
            } //if
         } //if
         if (HLA._me_logging_in)
         {
            //Acquisition succeeded: that Participant was available
            @wait_for( HLA._sem_me.planWait() );
            {
               HLA._me = _Participant;
               //Enter the <General> ChatRoom
//             HLA._me.divesting = false; //could be still true; will
be fixed later
               HLA._me.logged_in.setBoolean( HLA._me.owned = true );
               HLA._me.user_handle.setValue( HLA._me.handle.hashCode()
);
               //Removing _me from the waiting_room will trip
Attribute Scope Advisories
               HLA._rtiAmbassador.unassociateRegionsForUpdates(
HLA._me.handle, HLA._asrspl_Participant_waiting_room);
               //At this point, _me.handle is only associated with
_asrspl_Participant_nowhere
               HLA._me.chat_room_slot.setValue(
HLA._slot_nowhere_ChatRoom );
            } //synchronized(_me)
            HLA._sem_me.signal();
         } //if
      } catch (ObjectInstanceNotKnown ex) {
         //The Participant was unknown; it cannot be in the
waiting_room
         HLA._me_logging_in = false;
         HLA._me.name.setValue("");
      } //try

      //Note that a created Participant goes only _nowhere; it does
not pass through _waiting_room.
      //At this point the _Participant is only _nowhere.
      if (HLA._me_logging_in)
      {
         @subtask( ev_PEGCR.create( ev.identifier ) );
      }
      //Signal the waiting plnLoginUser that we're done
      HLA.sem_name_reservation.setChanged( );
   }
}
//end plnHLA_Participant_NameReservation_Failed
```

The `plnHLA_Participant_NameReservation_Succeeded` plan handles the successful outcome of Participant name reservations.

```
// File: plnHLA_Participant_NameReservation_Succeeded.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAobjectInstanceNameReservationSu
cceeded;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;

/**
Handles outcome of Participant (username) name reservation request.
 */
public plan
plnHLA_Participant_NameReservation_Succeeded
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAobjectInstanceNameReservationSucceeded ev;
   #posts event evtHLA_ParticipantEntersGeneralChatRoom ev_PEGCR;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(
evtHLAobjectInstanceNameReservationSucceeded ev )
   {
      return ( ev.objectName.charAt(0) == 'p' );
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }
   #reasoning method
   body()
   {
      /**
       * blfdatUsers does not list non-JACK clients (usernames)
       */
      //Prepare the general chat room association
      HLA._rhs_current_ChatRoom =
HLA._rtiAmbassador.getRegionHandleSetFactory().create();
      //Arrival ( <General> ) ChatRoom will be slot 2, so we set up
"current" accordingly
      HLA._rh_current_ChatRoom = HLA._rh_general_ChatRoom;
      HLA._rhs_current_ChatRoom.add( HLA._rh_current_ChatRoom );
      HLA._rtiAmbassador.commitRegionModifications(
HLA._rhs_current_ChatRoom ); //Won't complain if there are no mods to
commit
      HLA._asrspl_Participant_current =
HLA._rtiAmbassador.getAttributeSetRegionSetPairListFactory().create(1)
;
      HLA._asrspl_Participant_current.add( new
AttributeRegionAssociation( HLA._oahs_Participant_forUpdate,
HLA._rhs_current_ChatRoom ));
      //Note that the association has not been applied yet.
      //For chat_room_slot filtering, we associate all "forUpdate"
attributes to _dh_ChatRoomSlots regions.
      //We'd get InvalidRegionContext when subscribing if we included
the DeletePrivilege.
      @wait_for( HLA._sem_me.planWait() );
      {
         HLA._me.logged_in.setBoolean( HLA._me.owned =
HLA._me.subscribed = !( HLA._me.inscope = HLA._me.divesting = false )
);
         HLA._me.chat_room_slot.setValue( HLA._slot_nowhere_ChatRoom
);
         //The <General> ChatRoom; must have been "waiting_room"
         //( slot 1 ) previously.  If there were any federates
         //subscribed to the creation region (nowhere), there would be
         //Discovery and Auto-Update would trigger our
         //InstanceAttributeResponder and all that;
         //Hence the atomic register-and-put; the synchronized(_me)
         //would delay a bit until the _me.user_handle is set.
         //But since no-one subscribes to nowhere, there is no rush
         @wait_for( HLA._sem_theParticipants.planWait() );
         {
            HLA._theParticipants.put( HLA._me.handle =
HLA._rtiAmbassador.registerObjectInstanceWithRegions(
HLA._och_Participant, HLA._asrspl_Participant_nowhere,
HLA._me.name.toString() ), HLA._me );
         } //synchronized( _theParticipants )
         HLA._sem_theParticipants.signal();
         HLA._me.user_handle.setValue( HLA._me.handle.hashCode() );
      } //synchronized( _me )
      HLA._sem_me.signal();
      //Note that a created Participant goes only _nowhere; it does
not pass through _waiting_room.
      //At this point the _Participant is only _nowhere.
      if (HLA._me_logging_in)
      {
         @subtask( ev_PEGCR.create( ev.identifier ) );
      } //if
      //Signal the waiting plnLoginUser that we're done
      HLA.sem_name_reservation.setChanged( );
   }
}
//end plnHLA_Participant_NameReservation_Succeeded
```

The `plnHLA_Participant_OwnershipAcquisitionFailed` plan handles the failed outcome of a Participant attribute ownership acquisition attempt.

```
// File: plnHLA_Participant_OwnershipAcquisitionFailed.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipUnavailable;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the AttributeOwnershipUnavailable notification for
Participants
 */
public plan
plnHLA_Participant_OwnershipAcquisitionFailed
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributeOwnershipUnavailable ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAattributeOwnershipUnavailable ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
//    ev.theObjectClass.equals(
((Server.HLAchat)_HLA.as_object())._och_ChatRoomRegistry );
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }
   #reasoning method
   body()
   {
      HLA.sem_Participant_acquisition.setChanged();
   }
}
//end plnHLA_Participant_OwnershipAcquisitionFailed
```

The `plnHLA_Participant_OwnershipAcquisitionNotification` **plan handles the successful outcome of a Participant attribute ownership acquisition attempt.**

```
// File: plnHLA_Participant_OwnershipAcquisitionNotification.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAattributeOwnershipAcquisitionNo
tification;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the attribute ownership notification for Participants
 */
public plan
plnHLA_Participant_OwnershipAcquisitionNotification
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAattributeOwnershipAcquisitionNotification ev;
   #posts event evtHLA_ForceDivest evHLA_ForceDivest;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean
relevant(evtHLAattributeOwnershipAcquisitionNotification ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }
   #reasoning method
   body()
   {
      @wait_for( HLA._sem_theParticipants.planWait() );
//    synchronized(HLA._theParticipants)
      Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipant(ev.theObject);
//    //end of synchronized(HLA._theParticipants)
      HLA._sem_theParticipants.signal();
      _Participant.owned = !(_Participant.inscope =
_Participant.divesting = false);
      //There are two circumstances where we acquire Participants:
      //When we want to log in, and when another federate logs out and
shuts down.
      //In both cases we set up the ForUpdate Regions such that the
      //Participant arrives associated with _nowhere and
      //_waiting_room.  In the first circumstance, the
      //plnHLA_Participant_NameReservation waits on the
      //sem_Participant_acquisition and will move the Participant to
      //the _general ChatRoom.
      HLA.sem_Participant_acquisition.setChanged();
      //Just in case we somehow managed to acquire whilst switching to
shutting down mode
      if (HLA._me_shutting_down) server.postEvent(
evHLA_ForceDivest.create( ev.identifier ) );
   }
}
//end plnHLA_Participant_OwnershipAcquisitionNotification
```

The `plnHLA_Participant_OwnershipAssumptionRequest` **plan handles ownership assumption requests for Participant object attributes.**

```
// File: plnHLA_Participant_OwnershipAssumptionRequest.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipAssump
tion;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles OwnershipAssumptionRequests for Participants
 */
public plan
plnHLA_Participant_OwnershipAssumptionRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestAttributeOwnershipAssumption ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtHLArequestAttributeOwnershipAssumption
ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }

   #reasoning method
   body()
   {
//    Server.HLAchat HLA = (Server.HLAchat)_HLA.as_object();
      //Decline if we're in the process of shutting down (and thus
divesting).
      //Note that we return true because the plan was a success
      //even though we simply decided to ignore the request.
      if (HLA._me_shutting_down) return true;
      @wait_for( HLA._sem_theParticipants.planWait() );
      Server.HLAchat.aParticipant _Participant = HLA.SeekParticipant(
ev.theObject );
      HLA._sem_theParticipants.signal();
      //Acquiesce if able
      //If not subscribed, probably not up to date --decline
      if (!_Participant.subscribed) return true;
      //Note that the divesting federate will have offered ownership
      //to all federates, and that even if they all acquiesce, only
      //one will receive an ownershipAcquisitionNotification; if we
      //use attributeOwnershipAcquisition, there won't be any negative
      //feedback if we fail to get ownership --and we'll have an
      //outstanding acquisition request.
      //This is why it is preferable to use
attributeOwnershipAcquisitionIfAvailable
      //
      //Before acquiring, set up update regions so they do not lapse
during ownership transfer
      HLA._rtiAmbassador.associateRegionsForUpdates(
_Participant.handle, HLA._asrspl_Participant_nowhere );
      HLA._rtiAmbassador.associateRegionsForUpdates(
_Participant.handle, HLA._asrspl_Participant_waiting_room );
      HLA._rtiAmbassador.attributeOwnershipAcquisitionIfAvailable(
_Participant.handle, HLA._oahs_Participant ); //or theObject
   }
}
//end plnHLA_Participant_OwnershipAssumptionRequest
```

The `plnHLA_Participant_OwnershipDivestitureConfirmationRequest` plan handles requests for confirmation of divestiture of Participant object attributes.

```
// File:
plnHLA_Participant_OwnershipDivestitureConfirmationRequest.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestDivestitureConfirmation;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles requests for confirmation of ownership divestiture of
Participants
 */
public plan
plnHLA_Participant_OwnershipDivestitureConfirmationRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestDivestitureConfirmation ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestDivestitureConfirmation ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }
   #reasoning method
   body()
   {
      @wait_for( HLA._sem_theParticipants.planWait() );
      Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipant(ev.theObject);
//    synchronized(HLA._theParticipants)
      {
         HLA._rtiAmbassador.confirmDivestiture( _Participant.handle,
HLA._oahs_Participant, null );
         _Participant.owned = _Participant.divesting = false;
      } //synchronized(HLA._theParticipants)
      HLA._sem_theParticipants.signal();
      //There'll be a divestiture semaphore of some sort when logging
off
      HLA.sem_Participant_divestiture.setChanged();
   }
}
//end plnHLA_Participant_OwnershipDivestitureConfirmationRequest
```

The `plnHLA_Participant_OwnershipReleaseRequest` plan handles ownership release requests for Participant object attributes.

```
// File: plnHLA_Participant_OwnershipReleaseRequest.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLArequestAttributeOwnershipReleas
e;

/**
Handles requests for ownership release of Participants
 */
public plan
plnHLA_Participant_OwnershipReleaseRequest
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLArequestAttributeOwnershipRelease ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLArequestAttributeOwnershipRelease ev)
   {
      return true;
   }
   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }

   #reasoning method
   body()
   {
      //Acquiesce
      @wait_for( HLA._sem_theParticipants.planWait() );
//    synchronized(HLA._theParticipants)
      {
         Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipant(ev.theObject);
         //If _me, refuse (there is no RTI call to tell the requester
to piss off).
         //Here we fail the plan as a means of signalling our refusal.
         //Note that the JACK federates resign and shut down when not
         //logged-in, so the Java test on _me_logged_in becomes
         //redundant here.
         if (HLA._me_logged_in && _Participant.equals(HLA._me)) return
false;
         //Otherwise, acquiesce
         //Plan succeeds even though divestiture fails
         if (!HLA._oahs_Participant.containsAll(
HLA._rtiAmbassador.attributeOwnershipDivestitureIfWanted(
_Participant.handle, HLA._oahs_Participant))) return true;
         _Participant.owned = _Participant.divesting =
_Participant.inscope = false;
         //Region associations are automatically lost along with
ownership
      } //synchronized(_theParticipants)
      HLA._sem_theParticipants.signal();
      HLA.sem_Participant_divestiture.setChanged();
   }
}
//end plnHLA_Participant_OwnershipReleaseRequest
```

The `plnHLA_Participant_ProvideAttributeValueUpdate` **plan handles requests for Participant instance attribute value updates.**

```
// File: plnHLA_Participant_ProvideAttributeValueUpdate.java
package server;

import
ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAprovideAttributeValueUpdate;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import hla.rti1516.*;

/**
Handles attribute value update requests received from the RTI for the
Participants.
 */
public plan
plnHLA_Participant_ProvideAttributeValueUpdate
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAprovideAttributeValueUpdate ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAprovideAttributeValueUpdate ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }
   #reasoning method
   body()
   {
      @wait_for( HLA._sem_theParticipants.planWait() );
      Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipant(ev.theObject);
      HLA._sem_theParticipants.signal();
      AttributeHandleValueMap _ahvm_attributeValues =
HLA._rtiAmbassador.getAttributeHandleValueMapFactory().create(
HLA._oahs_Participant_forUpdate.size() );
      //In the HLA Chat federates, it is crucial to synchronize on
      //_Participant here, since the object's registration may trigger
      //this handler right away (because of Auto-Provide) --and the
      //object cannot fill its user_handle field in the same atomic
      //operation.
      //In JACK Clients, on the other hand, the callbacks are queued
      //up as posts on a single agent (the Server), hence this is not
      //a problem.
      _ahvm_attributeValues.put( HLA._oah_Participant_logged_in,
_Participant.logged_in.toByteArray() );
      _ahvm_attributeValues.put( HLA._oah_Participant_user_handle,
_Participant.user_handle.toByteArray() );
      _ahvm_attributeValues.put( HLA._oah_Participant_chat_room_slot,
_Participant.chat_room_slot.toByteArray() );
      HLA._rtiAmbassador.updateAttributeValues( _Participant.handle,
_ahvm_attributeValues, null );
   }
}
//end plnHLA_Participant_ProvideAttributeValueUpdate
```

The `plnHLA_Participant_ReflectAttributeValueUpdate` **plan handles Participant instance attribute value update reflections.**

```
// File: plnHLA_Participant_ReflectAttributeValueUpdate.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAreflectAttributeValues;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles attribute value updates received from the RTI for the
Participants.
 */
public plan
plnHLA_Participant_ReflectAttributeValueUpdate
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAreflectAttributeValues ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;
   static boolean relevant(evtHLAreflectAttributeValues ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null) &&
      HLA._rtiAmbassador.getKnownObjectClassHandle( ev.theObject
).equals( HLA._och_Participant );
   }

   #reasoning method
   body()
   {
      //HLAprivilegeToDeleteObject has no content, so we won't decode
it
      @wait_for( HLA._sem_theParticipants.planWait() );
      Server.HLAchat.aParticipant _Participant =
HLA.SeekParticipant(ev.theObject);
      HLA._sem_theParticipants.signal();
      {
         //The attribute Name matches the object's HLA name and is
updated at Discovery time
//       _Participant.name.setValue(
HLA._rtiAmbassador.getObjectInstanceName( ev.theObject) );
         _Participant.logged_in.decode(
(byte[])ev.theAttributes.get( HLA._oah_Participant_logged_in ));
         _Participant.user_handle.decode(
(byte[])ev.theAttributes.get( HLA._oah_Participant_user_handle ));

_Participant.chat_room_slot.decode((byte[])ev.theAttributes.get(
HLA._oah_Participant_chat_room_slot ));

         //This is where the JACK belief set model would need to put
         //the Participant in the proper ChatRoom.
         //Using either the _ChatRoomRegistry.list or
         //HLA.SeekChatRoomBySlot, one can find which ChatRoom name
         //corresponds to the Participant's chat_room_slot; then one
         //can add to blfdatGroups.
      }
      //Unlike the HLA Chat federates, a JACK Client that is not
logged in cannot subscribe
//    if (!HLA._me_logged_in) return true;
   }
}
//end plnHLA_Participant_ReflectAttributeValueUpdate
```

The `plnHLA_Interaction` **plan handles reception of messages.**

```
// File: plnHLA_Interaction.java
package server;

import hla.rti1516.*;
import ca.gc.drdc_rddc.hla.rti1516.omt.*;
import java.util.Iterator;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAreceiveInteraction;
import client.evtMessageUsr;

/**
Handles the evtHLAinteraction event
 */
public plan
plnHLA_Interaction
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAreceiveInteraction ev;
   #sends event evtRelayMessg evRelayMessg;
   #uses interface Server server;
   #reads data blfUsers blfdatUsers;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAreceiveInteraction ev)
   {
      //We could check the interaction class handle, but there is only
one
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
   }
   #reasoning method
   body()
   {
      HLAunicodeString _message = new HLAunicodeString();
      HLAunicodeString _sender = new HLAunicodeString();
      for (Iterator i = ev.theParameters.keySet().iterator();
i.hasNext(); )
      {
         ParameterHandle _parameterHandle = (ParameterHandle)i.next();
         if (_parameterHandle.equals(HLA._iph_Communication_message))
         {
            _message.decode(
(byte[])ev.theParameters.get(_parameterHandle) );
//          _message = new String(
(byte[])_theParameters.get(_parameterHandle) );
         } else if
(_parameterHandle.equals(HLA._iph_Communication_sender))
         {
            _sender.decode(
(byte[])ev.theParameters.get(_parameterHandle) );
//          _sender = new String(
(byte[])_theParameters.get(_parameterHandle) );
         } //if
      } //for
//    server.postEvent( evMessageUsr.message(
_sender.toString().substring(1), _message.toString(), HLA.username )
);
      logical String location;
      blfdatUsers.get( location, ev.identifier ); //HLA.username
      @send( location.as_string(), evRelayMessg.relay(
_message.toString(), _sender.toString().substring(1) ) );
      System.out.println( "   (relaying message to '" + ev.identifier
+ "')" ); // HLA.username
    }
}
//end plnHLA_Interaction
```

The `plnHLA_InteractionScopeAdvisory_Off` plan handles the interaction scope advisory in the "turn off" case; this simply means the Client is "alone" in the Chat federation.

```
// File: plnHLA_InteractionScopeAdvisory_Off.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAturnInteractionsOff;
import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;

/**
Handles the HLAinteractionScopeAdvisory event.
 */
public plan
plnHLA_InteractionScopeAdvisory_Off
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAturnInteractionsOff ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAturnInteractionsOff ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
      //No need to test (InteractionClassHandle)ev.theHandle
      //since we only subscribe to one interaction
   }

   #reasoning method
   body()
   {
      HLA._alone = true;
   }
}
//end plnHLA_InteractionScopeAdvisory_Off
```

The `plnHLA_InteractionScopeAdvisory_On` plan handles the interaction scope advisory in the "turn on" case; this simply means the Client is no longer "alone" in the Chat federation.

```
// File: plnHLA_InteractionScopeAdvisory_On.java
package server;

import ca.gc.drdc_rddc.hla.rti1516.jack.blfHLA;
import ca.gc.drdc_rddc.hla.rti1516.jack.evtHLAturnInteractionsOn;

/**
Handles the HLAinteractionScopeAdvisory event.
 */
public plan
plnHLA_InteractionScopeAdvisory_On
   extends Plan
{
   logical Object _HLA;
   Server.HLAchat HLA;
   #handles event evtHLAturnInteractionsOn ev;
   #uses interface Server server;
   #reads data blfHLA datHLA;

   static boolean relevant(evtHLAturnInteractionsOn ev)
   {
      return true;
   }

   context()
   {
      datHLA.get( ev.identifier, _HLA ) &&
      ( (HLA = (Server.HLAchat)_HLA.as_object()) != null);
      //No need to test (InteractionClassHandle)ev.theHandle
      //since we only subscribe to one interaction
   }

   #reasoning method
   body()
   {
      HLA._alone = false;
   }
}
//end plnHLA_InteractionScopeAdvisory_On
```

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List of symbols/abbreviations/acronyms/initialisms

3D	Three-Dimensional
ALSP	Aggregate Level Simulation Protocol
AMLCD	Active Matrix Liquid Crystal Display
ANSI	American National Standards Institute www.ansi.org
AOS	Agent-Oriented Software Pty. Ltd. www.agent-software.com
API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
ASIP	All-Source Intelligence Prototype/Producer
BDI	Belief Desire Intention
C^2	Command and Control
C^2IS	Command and Control Information System
CCIS	see C^2IS
CD	Compact Disc
CD-ROM	Compact Disc – Read-Only Memory
CGF	Computer-Generated Forces
CLI	Command-Line user-Interface
CMF	Collaborative Metaprogramming Framework
CORBA	Common Object Request Broker Architecture www.corba.org
DARPA	U. S. Defense Advanced Research Projects Agency www.darpa.mil
DDM	Data Distribution Management
DIF	Data Interchange Format
DIR	Defence Industrial Research

DIS	Distributed Interactive Simulation
DISTI	Distributed Simulation Technology Inc. www.simulation.com
DLL	Dynamic Link Library
DMSO	U. S. Defense Modeling and Simulation Office www.dmso.mil
DND	Department of National Defence www.dnd.ca
DoD	U. S. Department of Defense www.dod.gov
DRDC	Defence R&D Canada www.drdc-rddc.gc.ca
DRP	Document Review Panel
DSP	Defense Standardization Program www.dsp.dla.mil
DSS	Decision Support Systems
DTD	Document Type Definition
DUB	Dimension Upper Bound
FDD	FOM Document Data
FED	Field Emission Display
FEDEP	Federation Development Process
FIFO	First-In, First-Out
FOM	Federation Object Model
GALT	Greatest Available Logical Time
GEO-TIDE	Geospatial Technologies for Information Decisions
GUI	Graphical User-Interface
HLA	High Level Architecture
HPCVL	High Performance Computing Virtual Laboratory
ICM	International Congress of Mathematicians
IDE	Integrated Development Environment
IDL	Interface Definition Language

IEC	International Electrotechnical Commission www.iec.ch
IEEE	Institute of Electrical and Electronics Engineers www.ieee.org
INCITS	InterNational Committee for Information Technology Standards www.incits.org
IRC	Internet Relay Chat
ISBN	International Standard Book Number
ISO	International Organization for Standardization www.iso.ch
IST	(University of Central Florida) Institute for Simulation and Training www.ist.ucf.edu
JACK	*Originally stood for* Java Agent Compiler and Kernel
JAL	JACK Agent Language
JDE	JACK Development Environment
JNI	Java Native Interface
JTC	Joint Training Confederation
LFCS	Land Forces Command System
LITS	Least Incoming Time Stamp
LRC	Local RTI Component
M&S	Modelling and Simulation
MAGNETAR	Metaprogrammable AGent NETwork ARchitecture www.magnetar.org
MOM	Management Object Model
NATO	North Atlantic Treaty Organization www.nato.int
OLED	Organic Light-Emitting Diode
OMG	Object Management Group www.omg.org
OMT	Object Model Template
OO	Object-Oriented
OOAD	Object-Oriented Analysis and Design

OOTW	Operations Other Than War
ORB	Object Request Broker
PDG	Product Development Group
R&D	Research and Development
RMC	Royal Military College www.rmc.ca
RPR-FOM	Realtime Platform Reference FOM
RTI	Run-Time Infrastructure
SIMNET	SIMulator NETwork, *later became* SIMulation NETwork
SIREQ	Soldier Information Requirements
SISO	Simulation Interoperability Standards Organization www.sisostds.org
SO	Shared Object
SOM	Simulation Object Model
SPIE	Society for Photo-Optical Instrumentation Engineers www.spie.org
STANAG	Standardisation Agreement www.cri.ensmp.fr/OTAN/Serveur2.html
TCP/IP	Transmission Control Protocol/Internet Protocol
TD	Technology Demonstration
TFT-LCD	Thin Film Transistor – Liquid Crystal Display
ToMaDi	Topographic Map Display
TSO	Time-Stamp Order
UCF	University of Central Florida www.ucf.edu
UDP	User Datagram Protocol
USD (A&T)	U.S. Under Secretary of Defense for Acquisition and Technology www.acq.osd.mil
W3C	World Wide Web Consortium www.w3.org
XML	eXtensible Markup Language www.xml.org

XRTI	eXtensible Run-Time Infrastructure www.npsnet.org/~npsnet/xrti

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3. TITLE (Its classification should be indicated by the appropriate abbreviation (S, C, R or U)

(U) Simulation technologies for C^{2}IS development & training - Final report

4. AUTHORS (Last name, first name, middle initial. If military, show rank, e.g. Doe, Maj. John E.)

Thibault, Daniel U.

5. DATE OF PUBLICATION (month and year) February 2008	6a. NO. OF PAGES 1380	6b .NO. OF REFERENCES 40

7. DESCRIPTIVE NOTES (the category of the document, e.g. technical report, technical note or memorandum. Give the inclusive dates when a specific reporting period is covered.)

Project final report

8. SPONSORING ACTIVITY (name and address)

DLSC (Directorate of Land Strategic Concepts)
Box 17000 Stn Forces
Kingston ON K7K 7B4

9a. PROJECT OR GRANT NO. (Please specify whether project or grant) 12sd (12kr)	9b. CONTRACT NO.
10a. ORIGINATOR'S DOCUMENT NUMBER DRDC Valcartier TR 2007-412	10b. OTHER DOCUMENT NOS N/A

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Le fonctionnement de la norme de simulation répartie High Level Architecture (HLA) Institute of Electrical and Electronics Engineers (IEEE) 1516 est décrit de façon concise. L’environnement de développement d’agents logiciels intelligents JACK d’Agent Oriented Software (AOS) est décrit. Des problèmes sont identifiés au niveau de la norme IEEE 1516 et des améliorations possibles sont décrites. Une application semblable au clavardage Internet a été conçue et implémentée, permettant de démontrer comment HLA permet l’interfonctionnement d’une application Java avec une application JACK. Une capacité JACK réutilisable permettant à n’importe quel agent JACK de participer à une fédération HLA quelconque est décrite. Un cadre de classes Java implémentant les méthodes de codage et d’encodage de l’Object Model Template (OMT) HLA est décrit. Finalement, les bogues de JACK et du Run-Time Infrastructure (RTI) HLA sont documentés, et diverses considérations et leçons apprises discutées.

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